Assessing the Effectiveness of a Health Education Campaign for Improving the Awareness and Preventative Health Behaviors of Buruli Ulcer Disease Affecting Cocoa Farmers in the Ashanti Region of Ghana

by

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Henry Nagai

Thesis submitted in partial fulfillment of
the requirements for the degree of Master of Science in the Duke Global Health Institution in the Graduate School of Duke University

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ABSTRACT

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INTRODUCTION

Buruli ulcer disease (BU) is a necrotizing disease primarily affecting the skin, subcutaneous tissue, and bone. The disease, caused by *Mycobacterium ulcerans*, is the third most prevalent mycobacterial disease after tuberculosis and leprosy [1]. Although BU has been reported in regions throughout the world including Latin America, Western Pacific, Central Africa, and Asia, it disproportionately affects western Africa [2]. Among the western Africa countries, Ghana has reported the highest number of active cases [3]. Although the mode of transmission of Buruli ulcer disease is unknown, its prevalence is highly associated with stagnant water [4]. Therefore, rural areas where farming is a primary lifestyle are typically endemic areas.

In August 2012, Family Health International 360 (FHI360) and The Hershey's Company implemented The Buruli Ulcer Awareness, Prevention, and Treatment Project in the Ashanti Region of Ghana. The goal of this health education campaign was to improve farmers' knowledge, and attitudes of BU prevention and treatment methods

METHODS

In order to assess this campaign, interview-assisted surveys and focus group discussions were conducted within three districts where the campaign was implemented and two control districts. A structured questionnaire was used to collect data at the

household level. A total of 340 participants was surveyed within five districts. Semi-structured focus group discussions were conducted in two intervention districts and two control districts to assess the health education campaign.

ANALYSIS

All questionnaire responses were entered into Qualtrics and exported in STATA 12.1. An adjusted logistic regression with districts clustered by intervention condition (intervention versus control) for each outcome variable of interest was performed. If there was no difference between the intervention and control districts, then a second adjusted logistic regression was performed where districts was used as an independent variable instead of the intervention variable.

All transcripts from the focus group discussion were entered and coded in NVivo. One member of the research team coded each discussion into the pre-determined themes: knowledge of pathology of BU, and knowledge of treatment and preventative behaviors. These themes were compared between each district to identify differences between the districts that were exposed to the health education campaign and the districts that were not exposed.

RESULTS

The quantitative data showed that there was no difference between the intervention and control districts in the participants' knowledge of the causes, signs and symptoms, available treatments, and preventative behavior of Buruli ulcer disease. The

intervention districts showed significantly less negative attitudes toward Buruli ulcer victims when compared to those participants within the control districts. Generally, knowledge of pathology, treatment, and preventative behaviors were high in all districts regardless of the presence of the intervention.

Overall, the focus group discussion participants primarily demonstrated a clear understanding of correct BU knowledge of pathology, available treatments, and preventative behavior in all districts. In all FGDs, water and filth were mentioned as causes of BU prevalence. The FGDs expanded on participants' awareness of available treatments to include cost of treatment and travel to care as barriers to accessing said treatments.

CONCLUSION

The health education campaign had no impact on the general knowledge of Buruli ulcer disease. Due to the endemicity of all the districts, it is not surprising that all the participants properly identified the causes, signs and symptoms, available treatment, and preventative behaviors of BU. The participants in the intervention districts reported significantly less negative attitudes toward BU victims comparatively to the participants in the control districts. The districts where the health education campaign was implemented expressed less negative attitudes toward Buruli ulcer victims when compared to the control districts. Our data supports that follow-up health education campaigns should focus on creating neutral or positive attitudes toward BU victims.

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1. Introduction

1.1 Prevalence

Buruli Ulcer disease was first discovered in 1948 in Australia [5]. Since then BU has been reported within 30 countries while disproportionately affecting Western Africa countries. It is estimated that one-quarter of West Africa's population is affected by Buruli ulcer or complications of the disease such as a family member loosing their job or falling behind in the educational system. Within this region of the world, approximately 7,000 people develop BU annually [6, 7]. Benin, Côte d'Ivoire, and Ghana are among the most endemic countries in the world [7].

The first reported case in Ghana was recorded in 1971- beginning a steady increase in prevalence throughout the next three decades [5]. By 2002, four of Ghana's ten regions reported 5,619 cases through a national search for cases [5]. These highly endemic regions have a prevalence of 1.5 cases/1,000 individuals [6]. Furthermore, it is assumed that these highly endemic regions have underreported numbers due to the disease primarily affecting those in rural communities [5].

1.2 Pathology

Buruli ulcer disease is caused by *Mycobacterium ulcerans*, which produces a macrolide toxin. The toxin causes tissue damage [8], muscle weakness [9], and nerve

damage to the affected area [10]. These toxins not only cause degeneration of the tissue and muscle but also prevent proper regeneration of the affected tissue [8].

The progression of the disease can be divided into four stages. Within the first stage, non-ulcerative skin lesions form causing nodules, plaques, and edema [11]. The second stage is characterized by the formation of ulcers with undefined edges and the necrosis spreading beyond the ulcer itself [12]. In the third stage, a collection of macrophages migrates to the lesion, initiating the healing process. This process causes fibrosis, scarring, calcification, and contractures causing permanent disabilities [13]. The fourth stage is characterized by osteomyelitis, which is caused from the contractures of the ulcers over joints [14]. If the disease progresses to this stage, the patient will likely suffer from deformation of the affected area or need to have their limb amputated.

1.3 Transmission

The mode of transmission is unclear but there is a strong association between endemic areas and infected bodies of water. One of the leading hypotheses of transmission is a water bug. Typically, a water bug is a predatory insect feeding on plant material, aquatic invertebrates, and small vertebrates within the body of water in which it lives. Water bugs can survive in a variety of environments and typically water bugs are capable of flying onto land. Their vast feeding preferences and mobility may give rise to the transmission of Buruli ulcer disease [15]. Although this is the primary

hypothesis, studies have not been able to consistently demonstrate an insect's role in transmission [16, 17]. Other theories suggest that Buruli ulcer is introduced into the skin via trauma of the skin followed by contact with infected water from a reserve or infected water bugs [18, 19].

Although contact with infected water is typically associated with the transmission of Buruli ulcer, other theories are present within the literature. Mosquitos [20] and terrestrial animals [21, 22] that live near bodies of water have shown to be potential vessels for the disease. Other studies show that the mode of transmission is not associated with animals such as mosquitos or water bugs; rather different geographic features cause the transmission. Access to pumped water is associated with a decrease in the prevalence of BU suggesting that the disease is transmitted through the ingestion of infected water [23, 24]. Still other research suggests that a prick of vegetation to exposed skin may be the mode of transmission [12]. The variety of environments, in which Buruli ulcer disease is present, and the lack of consistent evidence continue to keep the mode of transmission unknown.

1.4 Risk Factors

A well-supported risk factor is proximity to stagnant water or swamplands [25]; yet literature is not specific to which behavioral interactions with the stagnant water is a risk factor. Studies suggest an association between contact with stagnant water and the

prevalence of BU [26] while other studies suggest that this is a skewed statistic over-representing the general term "contact with stagnant water" [25]. Some studies have reported only playing in water to increase the prevalence of BU, while bathing and fishing in those waters show no association [25]. Furthermore, some studies demonstrate fetching water or drinking from un-piped water is a risk yet the literature is not conclusive on these factors [4, 27].

Socioeconomic status and environment have also been identified as risk factors. Communities with lower economic status are more likely to have a higher prevalence of Buruli ulcer disease [2, 4]. Populations of a lower socioeconomic status tend to live in rural areas where stagnant water is more prevalent as well as decreased access to clean drinking and bathing water. Furthermore, communities near arsenic-enriched drainage channels [28, 29], mining operations[24], and deforestation [30, 31] have shown a higher prevalence of the disease.

Buruli ulcer disease disproportionately affects children below the age of 15 years of age [6]. Children may have a higher prevalence of the emergence of the disease due to their increased time spent playing around water or their less developed immune system [32]. The increased prevalence of Buruli ulcer within children is typically found in case detection or surveillance studies yet studies evaluating admitted patients to a variety health centers tend to show no age difference [33]. Some studies have also shown that

the elderly are as susceptible to the disease as the younger children [32]. Although Buruli ulcer disease is typically associated with young children, the literature does not present a coherent hypothesis.

1.5 Treatment

The most common form of treatment for Buruli ulcer disease is surgery of the affected area. At the early stages, nodules, papules, and small ulcers, the disease can be removed by a simple excision and immediately closed[1, 19]. At the advanced stages, a wide excision and skin grafting is required. This more complicated surgery not only increases the incidence of residual scaring and contractures [34] but can also be prohibitively expensive for the endemic communities [19, 35]. Furthermore, if the disease continues to develop, amputation may be required. After amputation, the patient has a high chance of losing their occupation and the creating an economic burden for the family [34].

In 2004, the WHO recommended the new treatment of Buruli ulcer disease consisted of a combination of rifampicin and streptomycin for eight weeks [36]. Several studies have shown that only four weeks of this combination therapy is necessary to eliminate the disease within cultured tissue; yet after 8 weeks of therapy the ulcers are completely healed [37, 38]. The effectiveness of this healing process is associated with the time at which patients seek treatment. In Benin, it was shown that 73% of the

patients, that sought treatment with an ulcer less than 5 cm and received combination therapy, were healed after 8 weeks [38]. At the later stages, the use of antibiotics with surgery has shown to reduce the recurrence rate to less than 2% [34]. Over the past ten years, the treatment of Buruli ulcer disease has significantly improved; yet in order to eradicate this disease, preventative steps need to be taken.

1.6 Prevention

Four preventative measures have been consistently shown to decrease the prevalence of Buruli ulcer disease. The most controversial preventative measure is the Bacilllus Calmette-Guerin (BCG) vaccine, which is typically given at birth to prevent leprosy [39]. In Uganda, it was shown that if a patient was re-administered the BCG vaccine and had not previously presented symptoms of Buruli ulcer disease, those patients were less likely to present BU symptoms within the next year than patients that did not have the BCG vaccine [40]. On the other hand, studies done in Benin [39] and Ghana [41] have shown that BCG does not provide protective affects for Buruli ulcer[42]. Unlike BCG vaccine, bathing with commercial bar soap and wearing protective outerwear are universally accepted preventative measures[27]. In studies conducted in the Côte d'Ivoire and Ghana, it was shown that wearing trousers while working in the farms was protective against BU [4]. The study in Côte d'Ivoire further found that the upper body was protected against BU when the farmers wore long sleeve shirts [41].

The most prominent prevention method for Buruli ulcer disease is health campaigns. Empowering the community with knowledge and resources allows the members to seek early treatment, which is the best preventative measure [43]. Seeking early treatment allows the patient to receive antibiotics, which will prevent the disease's progression and prevent the patient from possible deformations and amputations. Furthermore, the antibiotics have a lower financial impact on the family as compared to surgery. Several studies have shown that improved health education increases treatment at all stages of the disease [3, 44, 45] as well as decreases risk factors within endemic communities [3].

1.7 Perception of Buruli Ulcer Victims

Although Buruli ulcer disease is not stigmatized within endemic communities, studies have shown negative feelings to be associated with BU victims [46]. Kpadanou et al. reported 2.5% of the BU victims' families rejected them after contracting the disease [47]. Other studies have further shown adult BU victims to feel diminished, depressed, and reporting a low quality of life score [47, 48]. These negative attitudes have also been in shown in children [2]. While educating the population of BU, it is vital to decrease the negative perceptions of BU. The communities need to accept BU victims and be a support system through the healing process.

1.8 Awareness of the Disease In Ghana

In 2005, the World Health Organization (WHO) focused their efforts on BU in Ghana. The WHO Global Buruli Ulcer Initiative, WHO Emergency and Surgical Care project, and Ghana Ministry of Health assessed the current landscape of BU treatment; in turn, they created a program to improve the health facilities' preparedness of treating the disease. Health facilities within the Ashanti region hosted training sessions for proper surgical procedures and training of the health staff on awareness of the disease. Since 2005, the WHO has furthered their efforts in Ghana through dissemination of the surgical techniques to more hospitals, distribution of WHO BU materials, and discussion of BU programs to strengthen the current systems throughout Ghana [49].

2. Health Education Campaign

2.1 Health Education Campaign

In August 2012, The Hershey Company and Family Health International 360 (FHI360) Ghana piloted a Buruli ulcer disease health education campaign within three districts of the Ashanti region of Ghana. The primary purpose of the campaign was to train community health volunteers (CHWs) within each district. The CHWS were trained to identify cases of BU, properly refer the cases to an appropriate health facility, and educate the community through the use of reading material and community level campaigns. In order to achieve these goals, FHI360 contracted two local non-

governmental organizations (NGOs) to assist in this process. Water in Africa Through Everyday Responses (WATER) was contracted for two districts: Atwima Nwabiagya and Atwima Mponua. Buruli Ulcer Victims Aid (BUVA) conducted the health education campaign within the third district, Ahafo Ano North. These local NGOs were chosen due to their existing presence within each district and their shared interest in controlling Buruli ulcer disease in the endemic communities of the Ashanti region.

2.1.1 Training of Community Health Workers

The health education campaign aimed to train community health workers on essential information of Buruli ulcer disease, identify signs and symptoms of BU, and provide proper referral to those infected patients. Throughout October and November 2012, 35, 34, and 32 participants were trained within Ahafo Ano North, Atwima Mponua, and Atwima Nwabiagya respectively totaling 101 newly trained participants (Appendix A). Each trained participant underwent a three-day training conducted by FHI360 and the respective local NGO. The training sessions consisted of power point lectures, hands-on training, and role-playing scenarios. Although all the material used for training was in English, the material used supplementary pictures to further enforce the concepts and the training conducted by FHI360 was a mixture of the local language (Twi) and English. The information taught within the training session was in accordance to the World Health Organization's guidelines. The essential information discussed

included but was not limited to: cause, risk factors, sign and symptoms, treatment, registration of cases, and referral system.

2.1.2 Reading Materials

Another major component of the health education campaign was the distribution of posters, packets, laminated cards, comics, and guide booklets (Appendix B). All of the distributed reading material was WHO certified and in English. The largest proportion of the reading materials distributed were Buruli Ulcer Posters which primary used pictures to demonstrate each stage of the disease. These posters were distributed throughout each district and placed at health facilities, pharmacies, and central vendors. The Buruli ulcer packets were distributed to people in the community if they attended the community durbars (formal community meeting, typically lead by a king or chief). The laminated cards distributed in each district simply informed community members to *ACT NOW,* encouraging patients to receive early treatment for BU (Appendix C). Due to the children's high rates of BU, a comic book was used to teach children about the risk factors, sign and symptoms, and how to receive treatment. Finally, a Buruli ulcer guide booklet was used in the training of the community health workers to ensure the volunteers could detect cases of Buruli ulcer and inform the patients of the appropriate actions needed to help with their healing (Appendix D).

2.1.3 Community Level Campaigns

The community level campaigns primarily consisted of community durbars, outreach events, and case detection led by WATER and BUVA. The local NGO as well as the community chief led the community durbars, enforcing community involvement as well as support from key informants within each community. All community members were highly encouraged to attend the durbars where information regarding the prevalence, risk factors, and action steps was discussed. Due to all the communities being endemic, most participants were aware of Buruli ulcer disease. Therefore, a victim of Buruli ulcer disease may have shared a testimony about their experience during a durbar. These experiences were important to the health education campaign because it allowed the communities to recognize the importance of the disease as well as enforce community support of victims.

Similar to the community durbars, the outreach events involved community involvement; yet it was less formal than a durbar. These events used a PA system on top of a car to disseminate information. They may have consisted of a movie, a speaker, or the community health workers going door to door to talk to community members. Beyond providing information about BU to the community, these outreach events emphasized the importance of listening to the fears of the community and being able to provide one-on-one responses to concerned members.

The last component of the community level campaigns was case detection. The community health workers were trained to easily identify the signs and symptoms of Buruli ulcer disease. It was the duty of these trained workers to conduct case detection while either at the community durbars, outreach events, or when approached by a member of the community. If the worker identified a case of Buruli ulcer, they were instructed to provide the victim with information on the stage and immediate actions that were needed. Also, the worker recorded and reported the case to FHI360. The case detections allowed the victims to receive expedited care as well as provide a measurable outcome for a national database.

2.1.4 Achievements

Beyond the measurable results of training of health volunteers, distribution of reading materials, and implementing community level campaigns, the introduction of the health education campaign developed relationships between two local NGOs (BUVA and WATER), one international NGO (FHI360), and an international stakeholder (The Hershey Company). The foundation of these relationships has implications on future funding and partnerships to decrease the prevalence of Buruli ulcer. More importantly, the health education campaign formed a healthy relationship between all stakeholders and each community. Throughout the past year, the community members have become empowered to take the necessary steps within case detection and

treatment of BU, knowledgeable of local NGOs that are willing to assist, and established trust in the stakeholders building the capacity of the community as well as a long-term relationship.

2.2 Specific Aims

2.2.1 Aim One

Compare the Buruli ulcer disease related knowledge of cocoa farmers in the intervention districts where the health education campaign was implemented to the control districts where this health education campaign was not implemented.

2.2.1.1 Sub-Aim One

Compare the knowledge of the pathology and transmission of Buruli ulcer disease of cocoa farmers in the intervention districts and the control districts. Qualitative data was collected through the use of focus group discussions to determine the community's understanding of the causes of Buruli ulcer disease. Quantitative data was collected through interview-assisted surveys to determine the causes of Buruli ulcer disease, where the transmission of BU is most common, and the signs and symptoms of BU.

2.2.1.2 Sub-Aim Two

Compare the knowledge of the treatment and prevention methods of Buruli ulcer disease of cocoa farmers in the intervention districts and the control districts. Focus

group discussions were used to collect qualitative data on the participants' practices of prevention behaviors. Interview-assisted surveys collected quantitative data to determine the participants' awareness of different treatments of BU and prevention techniques.

2.2.2 Aim Two

Evaluate the negative attitudes held by cocoa farmers, within districts where the health education campaign was implemented and districts where this health education campaign was not implemented, toward Buruli ulcer victims. Quantitative data was collected via interview-assisted surveys to compare if the participants in the intervention arm differed in their avoidance and embarrassment of Buruli ulcer victims when compared to participants in the control arm.

2.3 Hypotheses

Our primary research question was to determine if there was a difference in knowledge of pathology and transmission of Buruli ulcer disease of cocoa farmers within endemic districts that received a health education campaign versus control endemic districts. We hypothesized that the districts with the health education campaign would have an increased awareness of its pathology and transmission.

Our secondary research question was to determine if there was difference in knowledge of prevention and treatment of Buruli ulcer disease of cocoa farmers within

endemic districts that received a health education campaign versus control endemic districts. We hypothesized that the districts where the health education campaign was implemented would report greater knowledge of treatment and preventative behaviors.

Our third research question was to determine if there was a difference in attitudes toward Buruli ulcer victims. We hypothesized the intervention districts would express neutral or positive attitudes toward BU victims; whereas, the participants within the control districts would express negative attitudes toward BU victims.

3. Methodology

3.1 Study Setting

The mixed methods study used focus group discussions and interview-assisted surveys of cocoa farmers in five endemic districts within the Ashanti region of Ghana to assess the effectiveness of a health education campaign (Appendix E). The intervention districts (Ahafo Ano North, Atwima Mponua, and Atwima Nwabiagya) were eligible for the health education campaign due to their high endemicity of BU. Furthermore, these districts were specifically chosen because of the existing community relationships with WATER and BUVA. The control districts were eligible if BU was endemic within the district, it did not share a border with an intervention district, and cocoa farming is prevalent. Ten districts within the Ashanti region were eligible to be a control district. Amansie Central and Ejisu Juaben were chosen due to the responsiveness of the district

health directors and willingness to cooperate with FHI360. Three communities and one community per district were chosen to conduct the interview-assisted surveys and focus group discussion respectively. These communities were chosen due to logistics of transportation, cocoa farming schedule, and recommendations made by the district health director.

3.2 Sampling Method

At a review meeting in May 2013, all local and international NGOs were informed of Duke University's involvement with the Buruli ulcer project. They were educated about the specific communities within each district, which would be interviewed in order to begin informing the health director and community health workers of our team's arrival. The Health Director of each district specified a contact people to begin mobilization and assist the research team upon their arrival. The specified contact person was an assistant of the Health Director who was familiar with the endemicity of Buruli ulcer disease. Furthermore, three communities per district were chosen by the Health Director to conduct the surveys and one community per district for the focus group discussion. The specified contacts traveled to each community and meet with the local chief for permission to conduct the research and community health volunteers to help mobilize participants for the focus group discussions or interview-assisted surveys. The community health volunteers were instructed to inform the

communities of the date of the research team's arrival. On these specific dates, the community health volunteers encouraged the cocoa farmers to break from the farm when the research team arrived within their community. Therefore, all recruitment was done by word of mouth. For the quantitative part of the study, 60 interview-assisted surveys were collected in each district totaling 340 surveys (Appendix F). The participants were surveyed via a convenience sampling method. Within each community, two survey workers went door-to-door until twenty surveys were completed per district aiming for a total of 60 surveys per district. The actual number of collected surveys varied between 60-75 surveys per district. One focus group was conducted in four of the districts, for a total of four groups. Each group had 8-15 participants, for a total of 46 focus group participants (Appendix G).

3.3 Eligibility

The participants were eligible to take part in the interview-assisted survey if the respondent was a cocoa farmer, above the age of 18 years, and was not part of the focus group discussion. A member of the community was not eligible to respond if another eligible person in their house previously responded to the survey or they did not live in the community that they were physically present at the time of the recruitment. Participants were eligible for the focus group discussion if the respondent was a cocoa farmer, above the age of 18 years old, and did not previously complete an interview-

assisted survey. Members were excluded from the focus group discussion if another member of their household was present in the focus group discussion or they did not live in the community that they were physically present in the time of the recruitment.

3.4 Data Collection

3.4.1 Interview-Assisted Surveys

A structured questionnaire was used to collect data at the household level, which consisted of four sections: demographic information, Buruli ulcer knowledge, history of Buruli ulcer disease, and attitudes/practice of Buruli ulcer prevention and treatment (Appendix H). On average the questionnaire took ten minutes to complete and each participant was given a bar of soap as compensation for his or her time. The survey research team consisted of ten workers who had an existing relationship with FHI360 Kumasi. Each survey worker was located within Kumasi and had no previous association with the implementation of the health education campaign. The Duke graduate student led a three-day training for the survey workers. The survey workers collectively translated the informed consent form and questionnaire to ensure proper context and reinforce the material to each worker.

For each district, six survey workers were used to collect data. Two trained workers went door-to-door in each community until twenty households were reached per community. The questionnaires were conducted in either English or Twi. At the end

of each day, the Duke graduate student checked each questionnaire for completeness and proper data collection methods. The graduate student shadowed each survey worker to further ensure consistent data collection methods. The responses were entered into Qualtrics for future analysis.

3.4.1 Focus Group Discussion

A semi-structured focus group discussion was conducted in the five districts. Each focus group discussion was divided into three topics: awareness of Buruli ulcer disease, effectiveness of the referral system, and attitudes of the community (Appendix I). The purpose of the awareness section was to understand how the community first learned of the disease as well as if they believed this method was effective. The second theme of the FGD aimed to understand the barriers that are encountered as patients sought medical aid from either the local health clinic or the district level hospital. The purpose of the attitudes theme was to understand the community's perception of Buruli ulcer victims and if the community's practices had changed since learning of Buruli ulcer disease.

Each discussion was conducted in Twi and lasted approximately 1.5 hours. The participants received soda and biscuits as compensation for their time. A moderator and a note-taker were present at each discussion. All discussions were audio recorded and transcribed and translated by the moderator while incorporating supplemental notes by

the note-taker. It was the note-takers responsibility to keep record of which participants was speaking at a certain time as to help the moderator with the transcription process. Both workers were located in Kumasi and had no previous association with the implementation of the health education campaign. The divisional director of FHI360 Kumasi trained the moderator and note-taker. These two workers collectively translated the informed consent and moderator's guide to ensure proper context and reinforce familiarity with the guide.

3.5. Data Analysis

3.5.1 Aim One

3.5.1.1 Sub-Aim One

Compare the knowledge of the pathology and transmission of Buruli ulcer disease of cocoa farmers in the intervention districts and the control districts. For the quantitative section, the data was put into a data management system, Qualtrics, and exported in STATA 12.0 for analysis. An adjusted logistic regression clustered by district was run on the outcome variables (Table 1). If there was no significant difference between the intervention and control districts, an adjusted logistic regression with districts as a covariate was run on the outcome variables. For the qualitative data, the transcribed data was entered into NVivo and coded by one researcher. The analytic method focused on themes gathered from the focus group discussions to create a node

structure. The same researcher recoded the data to the identified themes: mode of awareness, length of time being aware, and causes of Buruli ulcer. The finalized themes were compared between each district to determine if the health education campaign had an effect on the knowledge of Buruli ulcer disease.

3.5.1.2 Sub-Aim Two

Compare the knowledge of the treatment and prevention methods of Buruli ulcer disease of cocoa farmers in the intervention districts and the control districts. For the quantitative section, the same method was used as outlined above. The outcome variables for the knowledge of treatment and prevention methods are located in Table 1. The qualitative data will use the same analytic method. The themes identified for this aim are cost of treatment, travel to care, and change in preventative behavior.

Table 1: Table for Outcome Variables Used in the Logistic Regression

Theme		Outcome Variable	Description
Knowledge of Pathology and Transmission			
	Causes	Germs	A specific bacteria, all bacteria, or germs cause Buruli ulcer disease
	Common Locations	Swampy/Stagnant Areas	Swampy areas or stagnant water is a place where BU is commonly found
	Signs/Symptoms	Nodules/Plaques	Nodules or plaques are a sign or symptom of BU
Knowledge of Treatment and Prevention			
	Treatment	Antibiotics/Surgery	Antibiotics or surgery is an appropriate treatment for BU
	Prevention	Early Signs or	Detecting early signs or

		Symptoms	symptoms of BU is an appropriate preventative behavior
	Prevent Complications	Seek Treatment from Health Clinic	Seeking treatment from a health clinic is an appropriate behavior to prevent complications with BU
Attitudes Toward BU Victims			
	Attitudes	Think Less of a BU Victim	The respondent thinks less of a BU victim

3.5.2 Aim Two

Evaluate the negative attitudes held by cocoa farms, within districts where the health education campaign was implemented and districts where this health education campaign was not implemented. For the quantitative data, the analysis plan stated above was used. The outcome variable analyzed in the logistic regression is located in Table 1.

3.5.3 Logistic Regression

Table 2: Adjusted Logistic Regression Clustered by District

$$OR(y)= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_n x_n + \varepsilon$$

Variable	Description	Possible Values
Intervention (x_1)	Dichotomous	0- Control District 1- Intervention District
Age (x_2)	Continuous	
Gender (x_3)	Dichotomous	0- Female

		1- Male
Education (x_4)	Categorical	0- No Education 1- Primary 2- JHS/MSLC 3- Secondary 4- Tertiary
Child Below the Age of 15 years (x_5)	Dichotomous	0- No 1- Yes
Only Occupation is a Farmer (x_6)	Dichotomous	0- Other Occupations 1- Only Farming

If there was no difference between the intervention and control districts, then a second adjusted logistic regression was performed. Table 3 shows the logistic regression was adjusted using demographic variables. The independent variable used in the second regression was district instead of intervention arm.

Table 3: Adjusted Logistic Regression

$$OR(y)= \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots \beta_n x_n + \varepsilon$$

Variable	Description	Possible Values
District (x_1)	Categorical	0- Ahafo Ano North 1- Atwima Mponua 2- Atwima Nwabiagya 3- Amansie Central 4- Ejisu Juaben
Age (x_2)	Continuous	
Gender (x_3)	Dichotomous	0- Female 1- Male
Education (x_4)	Categorical	0- No Education 1- Primary 2- JHS/MSLC 3- Secondary 4- Tertiary

Child Below the Age of 15 years (x_5)	Dichotomous	0- No 1- Yes
Only Occupation is a Farmer (x_6)	Dichotomous	0- Other Occupations 1- Only Farming

4. Results

4.1 Interview-Assisted Surveys

4.1.1 Demographic Characteristics

A total of 340 cocoa farmers was surveyed from three intervention districts and two control districts. Within this sample population, 51% were male. Seventy-four percent of the cocoa farmers were between the ages of 31- 70. It was expected to have a larger proportion of cocoa farmers ages 18-31. This low proportion may have been due to the surveys being conducted during workdays; where the younger farmers were at their farms. The majority of the cocoa farmers had either a primary (22.65%) or JHS/MSLC-Junior High School/Middle School Leaving Certificate (44.12%) educational level. In all the districts except Atwima Nwabiagya, the majority of the participants only had cocoa farming as their occupation. Table 4 shows the demographic characteristics by district.

4.1.2 Knowledge of Pathology and Transmission Buruli Ulcer Disease

4.1.2.1 Causes of Buruli Ulcer Disease

Figure 1 shows that germs (67%), stagnant water (87%), and poor sanitation (67%) were the most commonly reported causes of Buruli Ulcer Disease. Within each district, less than one-quarter of the participants attributed BU to spirits or witches. It is important to note the low percentage of participants who reported that they did not know the cause of Buruli ulcer disease. Refer to Appendix J for results of responses categorized by district

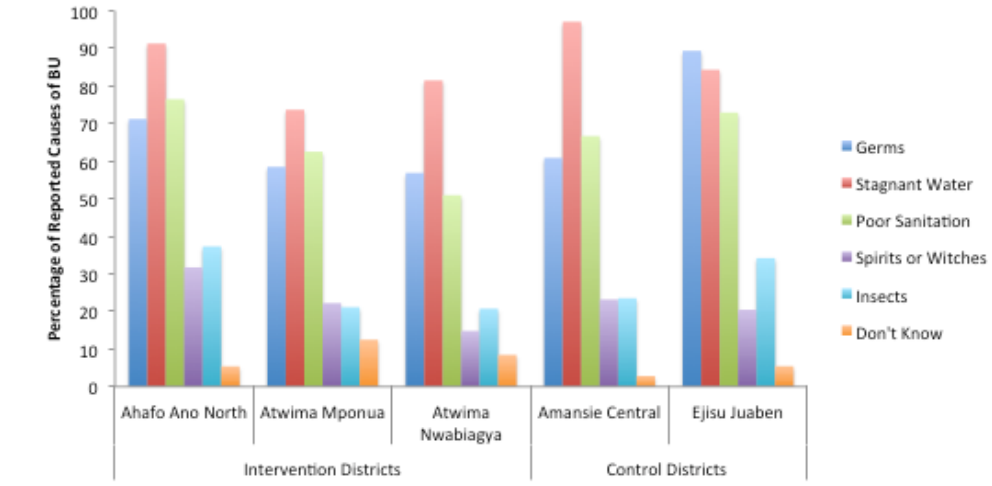


Figure 1: Percentage of Reported Causes of Buruli Ulcer Disease by Cocoa Farmers within Each District

Table 4: Demographic Data for the Participants Categorized by District

			Intervention Districts			Control Districts	
Demographic Characteristics		N (%)	Ahafo Ano North	Atwima Mponua	Atwima Nwabiagya	Amansie Central	Ejisu Juaben
Total		340 (100)	75 (22.06)	72 (21.18)	61 (17.94)	72 (21.18)	60 (17.65)
Gender							
	Male	173 (51.18)	35 (46.67)	38 (52.78)	27(44.26)	38 (52.78)	35 (60.34)
	Female	165 (48.82)	40 (53.33)	34 (47.22)	33 (55.74)	34 (47.22)	23 (39.66)
Age (years)							
	18-30	43 (12.65)	16 (21.33)	3 (4.17)	1 (1.64)	17 (23.61)	6 (10.00)
	31-50	152 (44.71)	32 (42.67)	29 (40.28)	30 (49.18)	33 (45.83)	28 (46.67)
	51-70	104 (30.59)	26 (34.67)	27 (37.50)	20 (32.79)	15 (20.83)	16 (26.67)
	71 +	41 (12.06)	1 (1.33)	13 (18.06)	10 (16.39)	7 (9.72)	10 (16.67)
Years as Cocoa Farmer							
	< 1	4 (1.23)	1 (1.35)	0 (0.00)	0 (0.00)	0 (0.00)	3 (5.17)
	1-5	52 (15.95)	16 (21.62)	5 (7.04)	8 (14.55)	10 (14.71)	13 (22.41)
	5-10	94 (28.83)	25 (33.78)	18 (25.35)	21 (38.18)	20 (29.41)	10 (17.24)
	10+	176 (53.99)	32 (43.24)	48 (67.61)	26 (47.27)	38 (55.88)	32 (55.17)
Children							
	Under 15	220 (67.48)	53 (70.67)	44 (64.71)	39 (69.64)	46 (64.79)	38 (67.86)
	Above 16	225 (69.88)	53 (70.67)	48 (69.57)	44 (80.00)	41 (57.75)	39 (75.00)
Marital Status							
	Single	24 (7.08)	6 (8.00)	3 (4.17)	5 (8.20)	5 (6.94)	5 (8.47)
	Married	258 (76.11)	55 (73.33)	59 (81.94)	45 (73.33)	55 (76.39)	44 (74.58)
	Divorced	31 (9.14)	9 (12.00)	8 (11.11)	8 (13.11)	5 (6.94)	1 (1.69)
	Separated	1 (0.29)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (1.69)
	Widow/widower	25 (7.37)	5 (6.67)	2 (2.78)	3 (4.92)	7 (9.72)	8 (13.56)
Education							
	Primary	77 (22.65)	22 (29.33)	16 (20.83)	9 (14.75)	17 (23.61)	14 (23.33)
	JHS/MSLC	150 (44.12)	28 (37.33)	29 (40.28)	37 (60.66)	26 (36.11)	30 (50.00)
	Secondary	16 (4.71)	3 (4.00)	4 (5.56)	3 (4.92)	3 (4.17)	3 (5.00)

	Tertiary	9 (2.65)	1 (1.33)	3 (4.17)	4 (6.56)	0 (0.00)	1 (1.67)
	None	84 (24. 71)	21 (28.00)	19 (26.39)	6 (9.84)	26 (36.11)	12 (20.00)
	Other	4 (1.18)	0 (0.00)	2 (2.74)	2 (3.33)	0 (0.00)	0 (0.00)
Occupation							
	Only Farming	185 (54.57)	43 (57.33)	41 (57.75)	167(27.87)	51 (70.83)	33 (55.00)
	Trader	86 (25.37)	22 (29.33)	14 (19.72)	21 (34.43)	15 (20.83)	14 (23.33)
	Artisan	19 (5.60)	2 (2.67)	5 (7.04)	5 (8.20)	3 (4.17)	4 (6.67)
	Teacher	4 (1.18)	0 (0.00)	2 (2.82)	1 (1.64)	0 (0.00)	1 (1.67)
	Health Worker	3 (0.88)	0 (0.00)	2 (2.82)	0 (0.00)	0 (0.00)	1 (1.67)
	Other	42 (12.39)	8 (10.67)	7 (9.86)	17 (27.87)	3 (4.17)	7 (11.67)

During the health education campaign, it focused on teaching the participants that germs are the primary cause of Buruli ulcer disease. In order to assess if the participant's location in either an intervention or control district predicts whether they answered correctly to the cause of BU, we performed a logistic regression. This adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years of age, and if farming was their sole occupation. The clustered logistic regression accounted for the adjusted variables clustered by the five districts. The district (intervention or control) was not indicative of whether a participant responded that germs cause BU (Appendix K).

Although the intervention districts did not significantly differ from the control districts, Figure 2 shows the adjusted odds ratio for a participant responding that germs cause Buruli ulcer disease when the districts are covariates of the logistic regression (Appendix L). The participants in Eijsu Juaben are 4 times more likely to respond that germs cause BU than in Ahafo Ano North, the referent group ($p < 0.05$). The adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation.

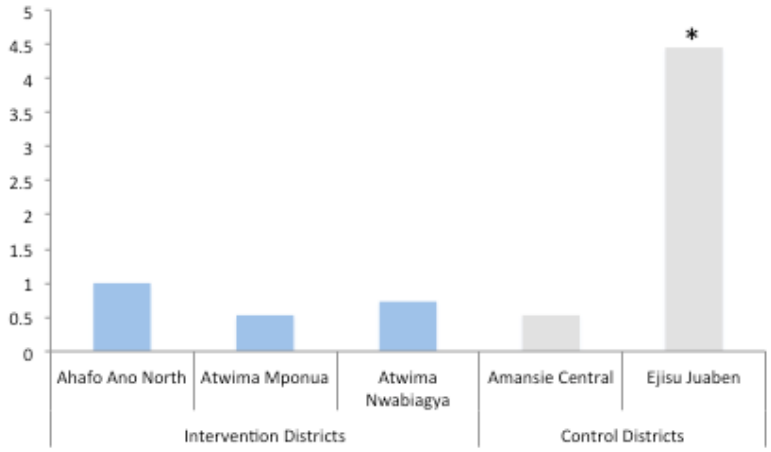


Figure 2: Adjusted Odds Ratio for a Participant Responding Germs Cause Buruli Ulcer Disease by District

4.1.2.3 Common Locations of Buruli Ulcer Disease

Figure 3 shows the majority (94%) of the cocoa farmers reported that Buruli ulcer disease is found in swampy areas or stagnant water. The participants reported that BU was found less often in unkempt cocoa farms (45%) and surface mining areas (52%). In all of the districts, less than 10% of the participants reported they did not know where Buruli ulcer disease was commonly found. Refer to Appendix J for results of responses categorized by district.

4.1.2.4 Signs and Symptoms of Buruli Ulcer Disease

Figure 4 show the reported signs and symptoms of Buruli ulcer disease within each district. Ninety-two percent of the cocoa farmers identified nodules/plaques as a sign of the disease. The more advanced stages of the disease were correctly reported less

often yet a majority of the respondents did classify edema (65%) and ulcers (69%) as symptoms of the disease.

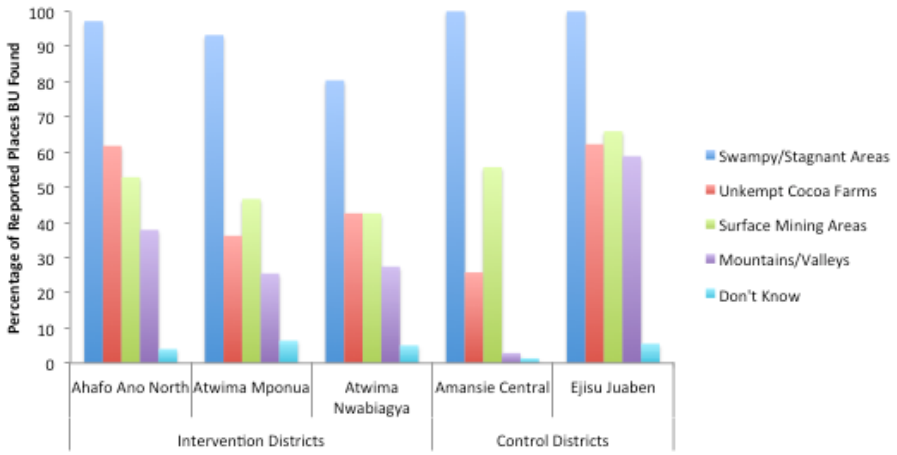


Figure 3: Percentage of Reported Places Buruli Ulcer Disease is Commonly Found by Cocoa Farmers within Each Districts

Buruli ulcer disease characteristically is not painful to the touch, although 63% of the participants reported it as such. In all the districts, 95% of the participants reported knowing at least one sign or symptoms of Buruli ulcer disease. Refer to Appendix J for results of responses categorized by district.

Although the health education campaign focused on all the stages of the disease, the primary focus was on the early signs and symptoms. Therefore, the primary outcome variable of the logistic regression was nodules/plaques as a sign/symptom of the disease. The adjusted logistic regression accounted for the covariates: age of the

participant, gender, education level, if the participant had a child below the age of 15 years of age, and if farming was their sole occupation.

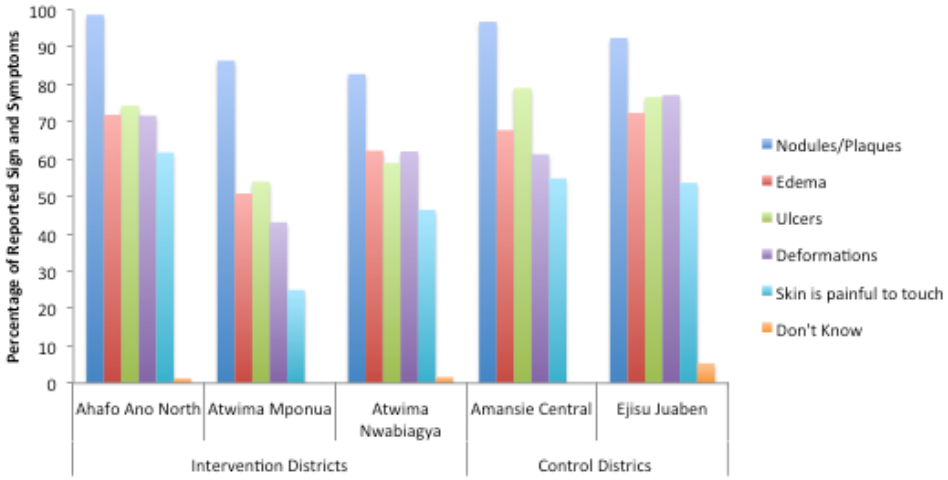


Figure 4: Percentage of Reported Signs and Symptoms of Buruli Ulcer Disease by Cocoa Farmers within Each District

The clustered logistic regression accounted for the adjusted variables clustered by the five districts. The type of district (intervention or control) did not predict whether a participant responded nodules/plaques were a sign or symptom of Buruli ulcer disease (Appendix M).

Figure 5 shows the adjusted odds ratio for a participant's district predicting that the participant will respond that nodules/plaques are a cause of Buruli ulcer disease. The participants in Atwima Mponua and Atwima Nwabiagya are less likely to respond that nodules/plaques are a sign/symptom of BU than in Ahafo Ano North, the referent group ($p < 0.05$). The adjusted logistic regression accounted for the covariates: age of the

participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation. Refer to Appendix N for results of the adjusted logistic regression.

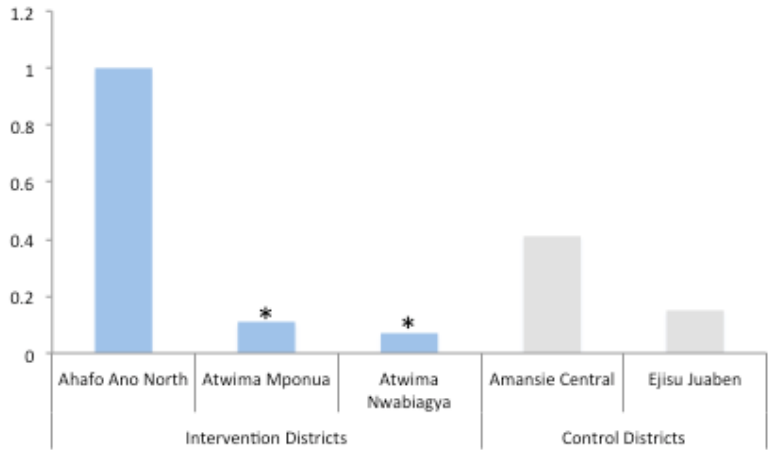


Figure 5: Adjusted Odd Ratio for a Participant's District Predicting a Participant to Report Nodules/Plaques as a Sign or Symptom of BU

4.1.3 Knowledge of Treatment and Prevention Methods of Buruli Ulcer Disease

4.1.3.1 Treatment of Buruli Ulcer Disease

The cocoa farmers within all five districts most commonly reported antibiotics (82%) and surgery (67%) as an appropriate treatment for Buruli ulcer disease. As shown in Figure 6, immunizations (43%) and drinking clean water (28%) were also reported as treatments against Buruli ulcer disease (Appendix O).

The outcome variable for treatment was if the participant responded that either antibiotics or surgery was an available treatment. The adjusted logistic regression

accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years of age, and if farming was their sole occupation. The clustered logistic regression accounted for the adjusted variables clustered by the five districts. The type of district (intervention of control) did not predict whether a participant responded that either antibiotics or surgery was an available treatment. (Appendix P).

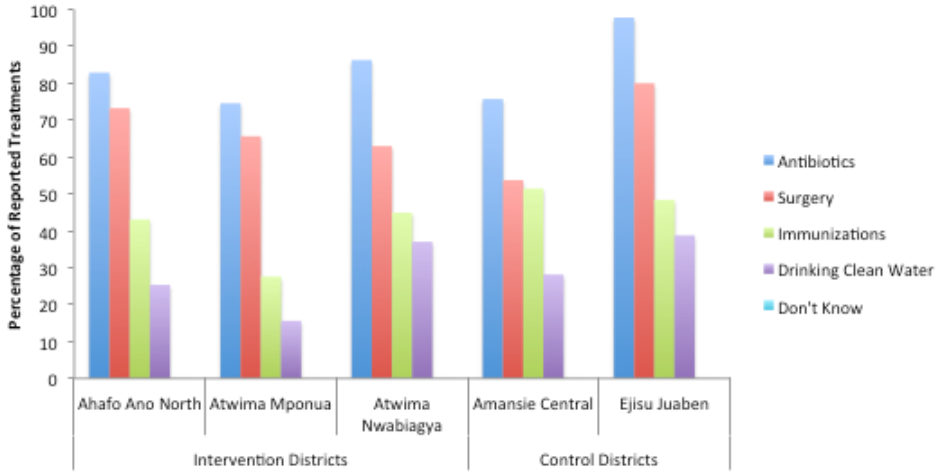


Figure 6: Percentage of Reported Available Treatment for Buruli Ulcer Disease by Cocoa Farmers within Each District

Although the intervention districts did not significantly differ from the control districts, Figure 7 shows the adjusted odds ratio for a participant responding either antibiotics or surgery cause Buruli ulcer disease when the districts are analyzed separately. The participants in Atwima Mponua are 0.8 times less likely to respond that antibiotics or surgery is an available treatment for BU than in Ahafo Ano North, the

referent group. The adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation. Refer to Appendix Q for results of the adjusted logistic regression.

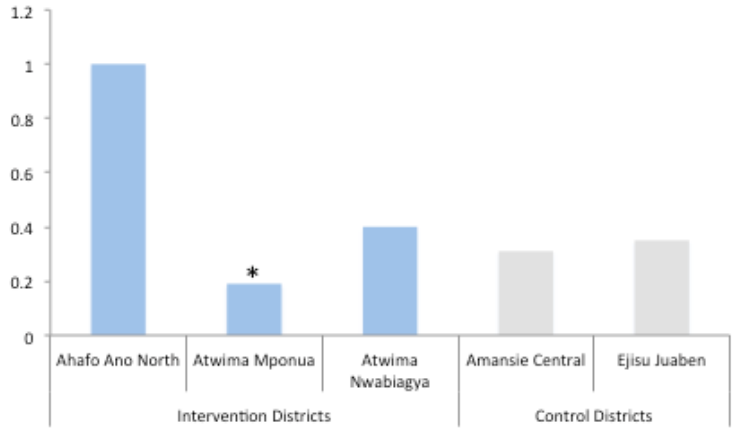


Figure 7: Adjusted Odds Ratio for a Participant's District Predicting a Participant to Report Antibiotics or Surgery as a Treatment of BU

4.1.3.2 Prevention of Buruli Ulcer Disease

Figure 8 shows the reported preventative behaviors to Buruli ulcer disease within each district. Three-fourths of the participants reported that washing oneself after contact with stagnant water and clean living conditions were preventative behaviors. Wearing protective clothing (67%) and early detection of signs and symptoms (65%) were also highly reported as appropriate prevention methods.

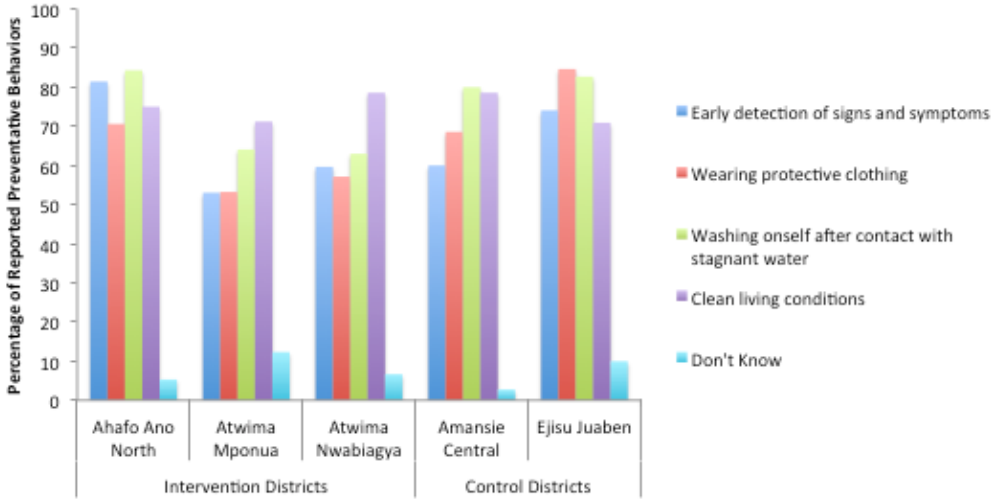


Figure 8: Percentage of Reported Preventative Behaviors of Buruli Ulcer Disease by Cocoa Farmers within Each District

While all of the reported behaviors are appropriate preventative behaviors, the primary outcome variable was early detection of signs and symptoms. The type of district (intervention or control) was not indicative of how a participant responded (Appendix R). The adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation. The clustered logistic regression accounted for the adjusted variables and clustered the data by the five districts.

Figure 9 shows the adjusted odds ratio that the participant's district predicts the participant to respond that early detection of Buruli ulcer disease is a preventative behavior of Buruli ulcer disease. The participants in Atwima Mponua and Amansie Central are 0.8 times and 0.7 times respectively less likely to respond that early detection

is a preventative behavior than in Ahafo Ano North, the referent group. The adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation. Refer to Appendix S for results of the adjusted logistic regression.

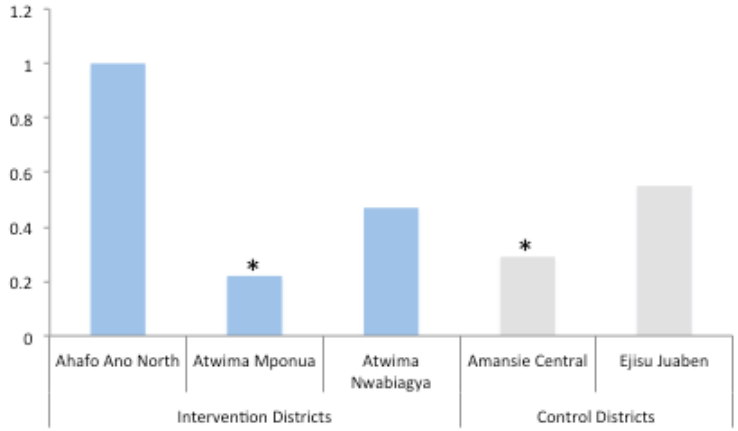


Figure 9: Adjusted Odds Ratio for a Participant's District Predicting a Participant to Report Early Detection as a Preventative Behavior

The majority (99%) of the participants reported that seeking treatment from a health clinic prevented complications of the disease. Figure 10 also shows that the respondents said that taking the full dose of antibiotics (57%) and seeking treatment from an herbalist (25%) are appropriate ways to prevent complications. There were no significant differences between intervention and control districts.

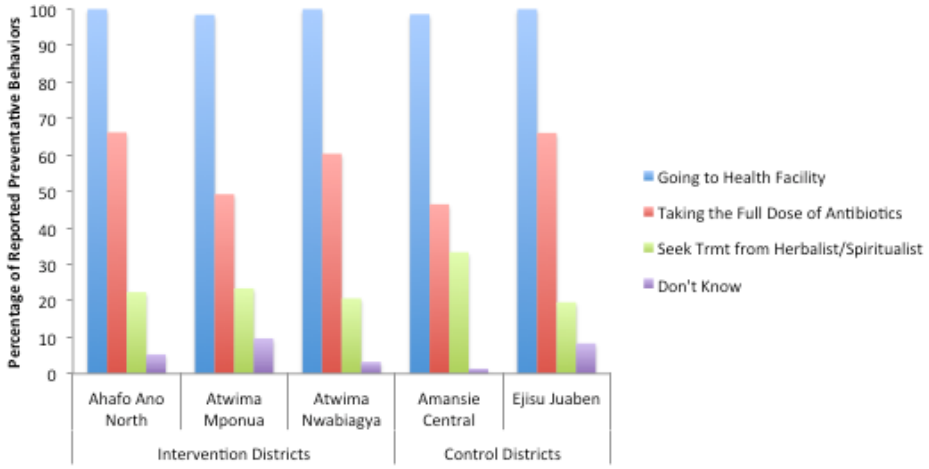


Figure 10: Percent of Reported Behaviors to Prevent Complications of Buruli Ulcer Disease Among Cocoa Farmers within Each District

4.1.4 Attitudes toward Buruli Ulcer Victims

The attitude section of the survey questioned the respondents on their attitudes toward another person that is affected with the disease. Figure 9 shows a low percentage of the participants that would think less of a BU victim (5%), avoid them or their family (5%), or be embarrassed by them (4%). There were significant differences between the intervention and control districts. The majority of the respondents (65%) stated that they would continue to have sexual relations with a BU victim. The participants' willingness to continue sexual activities not only demonstrates a positive attitude toward Buruli ulcer but also shows the participants' knowledge that this disease is not sexually transmitted. Refer to Appendix R for results of the adjusted logistic regression.

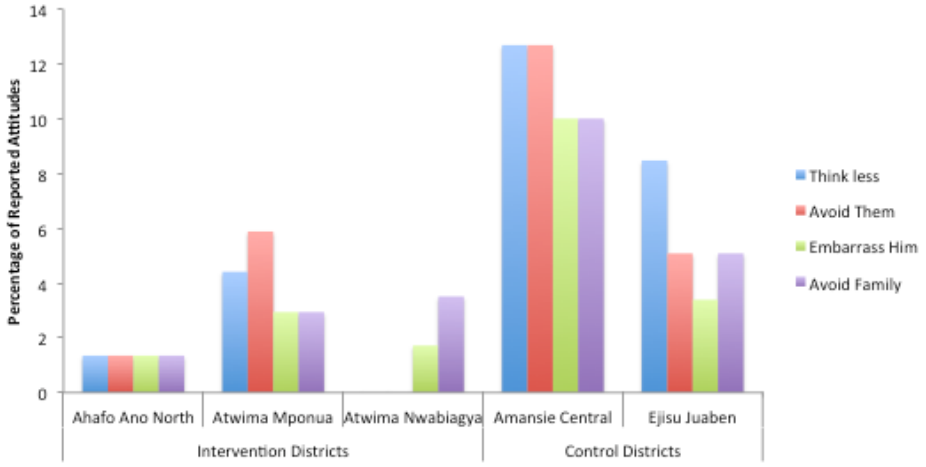


Figure 11: Percent of Reported Attitudes toward Buruli Ulcer Victims by Cocoa Farmers within Each District

Table 5 shows the association between type of district and the cocoa farmers responding that they would think less of a Buruli ulcer victim. The adjusted logistic regression accounted for the covariates: age of the participant, gender, education level, if the participant had a child below the age of 15 years, and if farming was their sole occupation. The clustered logistic regression accounted for the adjusted variables and clustered the data by the five districts. A participant in the control district is 9 times more likely to think less of a BU victim than a participant in the intervention district ($p < 0.05$).

Table 5: Covariates Associated with the Crude, Adjusted, and Clustered Odds Ratio of a Participant Responding that they Would Think Less of A Buruli Ulcer Victim

		Crude		Adjusted		Adjusted and Clustered		
		OR	95%	OR	95%	OR	95%	p-value
Intervention								
	Control	1.00	Ref	1.00	Ref	1.00	Ref	
	Intervention	0.17	(0.05-0.53)	0.11	(0.03-0.42)	0.11	(0.05-0.27)	0.00*
Age								
		0.99	(0.96-1.02)	0.98	(0.94-1.02)	0.98	(0.96-1.00)	0.10
Gender								
	Female	1.00	Ref	1.00	Ref	1.00	Ref	
	Male	0.45	(0.16-1.22)	0.17	(0.05-0.65)	0.17	(0.07-0.45)	0.00*
Education								
	None	1.00	Ref	1.00	Ref	1.00	Ref	
	Primary	1.30	(0.38-4.46)	2.20	(0.56-8.59)	2.20	(0.84-5.78)	0.11
	JHS/MSLC	0.54	(0.15-1.93)	0.81	(0.17-3.87)	0.81	(0.28-2.31)	0.33
	Secondary	2.17	(0.38-12.32)	10.98	(1.12-107.35)	10.98	(4.18-28.90)	0.00*
	Tertiary	1	N/A	1	N/A	1	N/A	N/A
Child Below 15 yrs								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	0.84	(0.30-(2.33)	0.91	(0.25-3.27)	0.91	(0.20-4.06)	0.90
Only Occupation: Farming								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.33	(0.50-3.52)	2.05	(0.59-7.11)	2.05	(0.49-8.64)	0.33

4.2 Focus Group Discussion

These qualitative results are to be used as a compliment to the quantitative data. These results were collected from a small sample size and the research team was not

present at any of the focus group discussions. The transcribed scripts excluded a portion of the audio recording, where the specifics of said missing data are unknown to the research team. Given the limitations of this data, it is important to prioritize the quantitative data over the qualitative data when the results are at odds.

The purpose of these focus group discussions was to obtain a general understanding of the cocoa farmers' knowledge of Buruli ulcer disease. Although the differences of focus group discussions conducted in the interventional and control districts will be noted; it was not the primary purpose of the focus group discussions. Each focus group was centered on three topics; knowledge of the pathology, knowledge of available treatment, and knowledge of preventative behaviors.

4.2.1 Knowledge of the Pathology of Buruli Ulcer Disease

Due to the endemic nature of Buruli ulcer disease in each selected district, it was expected that all participants would have awareness of the disease. Therefore, the focus group discussion was used to understand the community's knowledge of the causes of the disease (Table 6).

Table 6: Focus Group Discussion Questions for Knowledge of Pathology and Transmission of Buruli Ulcer Disease

Theme	Awareness
Purpose	Understand the background knowledge that each participant has on Buruli ulcer disease
Questions	1. What do you think causes Buruli ulcer disease? 2. Where did you learn about the causes of Buruli ulcer disease?

4.2.1.1 Causes of Buruli Ulcer

The majority of participants' identified water as the cause of the disease. There was not a cohesive opinion as to the specific interactions with water yet the two most common water-related causes were drinking from places other than "pipe-born water" and being in contact with streams. The participants further specified that the water that was most likely to cause Buruli ulcer disease within their community was either swampy areas or stagnant water bodies. Typically the participants elaborated that the reason these two water areas were a higher risk was because worms or insects "can hide in the water and when you step in it, you can be affected with the disease".

Cocoa farmers also reported filth to be a determinant of acquiring BU. Interestingly elaborations of "filth" were typically not provided, and it was generally accepted among all the participants that saying this general term was sufficient. A few cocoa farmers combined filth and water to suggest that it was only the filth within the water that caused the disease.

> "Filth can also cause Buruli ulcer. I got to know from some doctors who came to our village to create awareness on BU"
>
> "When it rains, the rainwater carry filth into the streams/rivers and because that is our main source of water in this village, we can easily be affected with the disease. I got to know of this cause because they educated us that the disease comes as a result of filth."

The opinion that demons was the cause of the disease differed between the intervention and control districts. Within the intervention districts, no participants

expressed the belief that demons or witches affected one's being affected by Buruli ulcer disease. Furthermore, at least one participant within the two intervention districts mentioned that demons were not the cause of Buruli ulcer disease. These sentiments are in contrast to the control districts where the participants had mixed feelings on the interaction of demons and Buruli ulcer disease.

"2301- I said it could be demons causing this because, there is witchcraft all over and they are capable of causing it.
2305- Please I don't agree with what she said. The health personnel always tell us it is caused by dirty water.
2301- Me, I know that, because we are not dealing with flesh and blood [physical body] but against principalities [spirits]"

4.2.2 Knowledge of Treatment

Within each FGD, it was evident that the participants' understood that seeking treatment from a health clinic was the primary treatment method for BU. Many of participants listed specific health clinics or district hospitals that provided appropriate treatment for the disease. Hence, the focus group discussion was used to understand the barriers of seeking proper treatment (Table 7). The two primary barriers discussed were cost of treatment and travel to care.

Table 7: Focus Group Discussion Questions for the Knowledge of Available Treatments

Theme	Knowledge of Treatment
Purpose	Understand the knowledge of treatment available for Buruli ulcer disease; Understand the communities' barriers to treatment
Questions	1. Are you aware of health facilities that can provide care for Buruli ulcer disease?

2. If you have gone to a local health facility and have been referred to the district hospital but did not go, why?

3.2.2.1 Cost of Treatment

A barrier discussed by participants of all districts was the cost of treatment. Some of the participants recounted how the treatment is advertised as free yet it is only for those who have health insurance. Since the majority of people within the rural communities do not have health insurance, it can be an unexpected expense for the family.

"My brother went to Agogo [district BU hospital] and he was not happy because he thought medication was free but when he got there he was asked to pay money."

Even when the participants know that the treatment will cost money, it is still too expensive for them to afford. This is a potentially worse outcome because the victims do not even attempt to go to the hospital. In most cases, patients that seek health treatment will be educated on the causes of BU, how the progression of the disease will affect their life, and where to find the community health workers that are knowledge about the disease. This information is provided to all patients whether or not they receive care for the disease. Therefore, the lack of information and potential support for the victims could worsen their experience with BU if they remain within their home.

"It's about money, most mothers in this village are single parents and when their children are affected they don't have money to take them to the hospital. That is why we are pleading that they should assist us with money to help the people who are affected with BU"

4.2.2.2 Travel to Care

Another one of the most prominent reason the participants mentioned that they did not seek the appropriate treatment was due to the travel to care. The distance of the appropriate health centers impacts the participant's decision to seek treatment. In all the districts, expect Ahafo Ano North, it was a united opinion that victims delayed seeking treatment if the health facilities were far. It is interesting to note that the participants understood this risk to their health and the complications that this delay in treatment could cause, yet the distance still prevented them.

> "It was not a good experience at all for the boy and his parent because, the referral center was very far"
>
> "If the doctor is close, health care will not be that difficult"

The travel to care is comprised of both time to care and cost to care. The previous sentiments did not distinguish between these two components; yet many of the participants specifically identified the high cost of transport to be a barrier to their health seeking behavior.

> "I know of two facilities, Agroyeseum and Nkawie and it's far from here. You have to spend about GHC 60.00 [30 USD] before you get there."
>
> "The reason why we don't go is that there is no money for transport."

4.2.3 Knowledge of Prevention Methods

Within the FGD, the participants were asked to discuss ways they have been taught to prevent contracting Buruli ulcer disease. The purpose of this probing was to

understand if the participants changed their behavior since learning of the causes of BU. Within this theme, the subtopics discussed included preventative behaviors, change in behaviors, and barriers to change in behaviors (Table 8)

Table 8: Focus Group Discussion Questions for Knowledge of Prevention Methods

Theme	Knowledge of Prevention Methods
Purpose	Understand the practice of prevention that the community has toward Buruli ulcer disease
Questions	1. Have you changed your lifestyle or any practices since you have learned of BU? 2. Do you want to change your behaviors but do not feel as though you can? 3. If you realized you were presenting with symptoms of BU, when would you decide to go to a health facility? 4. Are there any practices you know that you should not do; yet do anyway?

4.2.3.1 Change in Behavior

The majority of the participants reported a change in behavior after being educated on the disease. The typical changes that the cocoa farmers discussed were drinking boiled water, wearing protective clothing while being in contact with infected water, and no longer bathing in the streams. Many of the cocoa farmers mentioned their initiative to educate their children as well as change the child's behavior to limit their exposure to infected water. Some of the participants commented on the positive experiences of these changes causing "the farmers have now become healthy and are able to work well in their farms".

"All the cocoa farmers in my village now have agreed to wear overall and walling ton boots anytime they are working in the farm to prevent the disease, because they also had the opportunity to become part of the FGD."

While the participants discussed the changes their community had made, they also presented the reasons why certain behaviors were not feasible to change. The most prominent barrier to change was the lack of access to clean water while working the farms. The cocoa farmers expressed frustration being forced to drink and wade in the water that they knew would cause them harm.

"We know it is the stream that causes the disease, but, anytime we are working in the farm and we become thirsty, we are left with no other option than to fetch the stream and drink it like that, it is the same water we also fetch to water our crops"

"I do want to change my behavior but there are some things that are preventing me that is, I can't stop drinking from the streams even if I have to boil it when I'm in the farm and I'm thirsty I just go to the stream and drink"

5. Discussion

5.1 Knowledge of Pathology and Transmission of Buruli Ulcer Disease

5.1.1 Causes of Buruli Ulcer Disease

Our hypothesis stated the intervention districts would report germs as the cause Buruli ulcer disease more frequently than the participants from the control districts. Our findings did not show a significant difference between the responses of the control and intervention districts. When the districts were analyzed separately, it was evident the participants in Ejisu Juaben were more likely to respond that germs cause BU. These

results may have skewed the data for the control districts as having more knowledge of the causes than is true. This is the first study to ask participants if germs cause Buruli ulcer disease. Although there was no difference between the intervention and control districts, it is an important to highlight the communities' knowledge of Buruli ulcer disease originating from germs.

Previous studies have identified an understanding of stagnant water or swampy areas to be a risk factor of BU [25, 26, 50]. While our findings are consistent with these findings, our results show a larger proportion of the participants' reporting either germs or stagnant water as the cause of Buruli ulcer disease. In past studies, participants' overwhelming report that they do not know the cause of Buruli ulcer disease [2]; whereas, our finding show that less than 7% of the participants reported they did not know of a cause.

Within the interview-assisted surveys and FGDs, witches/spirits was identified as a causative factor of BU. Many previous studies have shown that endemic communities recognize witchcraft to be one of the causes of BU [46, 51]. The quantitative results did not show a difference between the control and intervention districts; yet the participants' reported witches or spirits to cause Buruli ulcer disease significantly less than other factors. These results differ from previous studies where witchcraft and wading in swampy areas was reported with the same frequency [2], or spirits were

reported as a cause in more than half of the participants [46]. The FGDs within the control districts showed similar results to the quantitative data where there were mixed results of spirits/witches as a causative factor. The FGDs in the intervention groups did not mention witches/spirits. This difference may have been due to participants' in the FGDs within the intervention districts afraid to speak of spirits if the majority of the other participants did not believe that spirits caused BU.

5.1.2 Signs and Symptoms of Buruli Ulcer Disease

The health education campaign discussed each stage of the disease yet there was a larger emphasis on the earlier signs and symptoms of Buruli ulcer disease: nodules and plaques. Therefore, our hypothesis stated the intervention districts would report nodules and plaques are a sign of BU at a higher rate than the control districts. Our resulted did not support our hypothesis. Interestingly, the intervention districts significantly differed in their responses. One possibility for this difference may be that BUVA conducted the health education campaign in Ahafo Ano North and WATER conducted the campaign in Atwima Mponua and Atwima Nwabiagya. Although the materials distributed were the same, the community durbars may have had a greater focus on these signs/symptoms when compared to other districts.

This is the first study to evaluate a community's knowledge of the signs and symptoms of BU. Our findings show that all the participants have a high understanding

of all the signs and symptoms of the disease with only 2% of the participants responding that they did not know of the signs and symptoms.

Previous studies have suggested that one of the reasons for low early case detection and diagnosis among Buruli ulcer victims is due to the lack of knowledge of the signs and symptoms [45, 52]. The results of this study show that the majority of the participants of the surveys and FGDs and across all districts correctly identified the early signs and symptoms of the disease. Interestingly, the participants most commonly reported the first stage- a nodule or plaque. Within these endemic districts of the Ashanti Region of Ghana, the lack of proper knowledge of the disease is not a reason that the people do not seek early treatment.

5.2 Knowledge of Treatment and Prevention Practices

5.2.1 Treatment of Buruli Ulcer Disease

Through the results of the survey, it is evident that this targeted population is aware of the WHO's recommendation to treat Buruli ulcer disease with a combination of antibiotics or surgery. It is surprising that a lower percentage of the population reported surgery as a viable treatment since surgery has been the longest established form of treatment [53]. The awareness of antibiotics and surgery signifies that these communities understand the courses of action they need to undertake when presented with symptoms of the disease. Also, it is important to note that the majority of the

participants realized that they could not treat the disease at home but rather needed to visit a health professional. The adjusted logistic regression showed Atwima Mponua to have reported antibiotics or surgery as an appropriate treatment 0.8 times less than the referent district. Even though this district significantly differed, within the district itself the majority of the participants reported antibiotics or surgery as the appropriate treatment demonstrating this district is aware of the correct treatments.

As mentioned earlier, the participants correctly identified the correlation between stagnant water and prevalence of Buruli ulcer disease. Due to the lack of solid understanding of its transmission method, this association with water can cause other misguided ideas of appropriate treatments. Approximately, one-quarter of the survey participants reported that drinking clean water was an appropriate treatment for BU. Although previous studies have shown that there is no correlation between drinking water and BU [2, 27], other studies suggest that drinking unclean water is a risk factor for BU [4]. Within the FGD, The cocoa farmers continually expressed their desire to drink clean water to avoid contracting the disease. This data suggests the participants lack an understanding between the interaction with water and the prevalence of the disease. It is important for the districts to understand that drinking clean water may be a preventative behavior but it is not a treatment for the disease.

The FGDs further supported the quantitative data demonstrating the participants appropriately identified the treatments (antibiotics and surgery), yet the FGDs further probed the community as to why an affected individual would not seek treatment. The results identified the cost of treatment and travel to case as barriers to appropriate treatment, which is consistent with the literature. Previous studies have identified the high cost of the treatment itself whether the treatment consists of surgery, antibiotics, or wound care can be a stressor for the family [43, 54]. Hospers et al. identified that the distance to treatment centers correlated with participants' willingness to seek treatment [55]. Our FGDs emphasized that the barrier of travel to a Buruli ulcer district hospital included an excessive amount of time as well as the high cost of transportation to those hospitals. Buruli ulcer disease is most commonly found in rural areas; therefore, the travel to care is an important factor to take into account.

5.2.2 Prevention of Buruli Ulcer Disease

The most recognized method of prevention of Buruli ulcer disease is through early detection of signs and symptoms [45]. The results from the survey participants were consistent with this previous research demonstrating that the cocoa farmers within these districts understand the importance of seeking treatment from a health clinic as well as the timely urgency associated with the disease. While there was no difference between the intervention and control districts, one intervention district (Atwima

Mponua) and one control district (Amansie Central) were significantly less likely to report early detection as a prevention behavior. Within each district, the participants reported washing oneself after contact with stagnant water and wearing protective clothing more frequently than early detection of signs and symptoms. These results were similar to the FGDs where the participants reported reduced contact with infected water and wearing protective clothing were appropriate prevention for the disease. All of the mentioned behaviors are preventative to BU; therefore, the districts have a clear understanding of the prevention behaviors.

5.3 Attitudes toward Buruli Ulcer Victims

There was a significant association between the type of district and attitudes toward Buruli ulcer victims. The participants in the control districts were nine times more likely to report negative attitudes toward BU victims. Our findings in the control districts are consistent with previous literature reporting BU victims are negatively impacted in a societal context [47, 48, 56, 57]. The findings in the intervention districts are inconsistent with previous literature. The increased discussion of Buruli ulcer disease, case detections, and more prominent informational activities highlighting affected community members may be one reason the participants within the intervention districts reported less negative attitudes than the control districts.

Although Buurli ulcer disease is not stigmatized, the victims of BU have previously reported negative impacts on their lifestyle. Amoakoh et al. showed that children affected with the disease are more likely to become social isolated at school [56]. Many other studies further discussed the negative impacts that BU has among the familial and occupational relations [47, 48, 57]. The results from our survey did not show the participants having a negative perception of BU victims; therefore, our data is inconsistent with previous data. Although, it is important to note that the negative perceptions were significantly higher in the control districts than the intervention districts.

5.5 Limitations

The primary limitation of this study was the small sample size. Due to the small number of participants in each district, the reported significant differences between the intervention and control districts may be under representative of the actual impact of the health education campaign. Furthermore, we used an adjusted logistic regression with nested districts to account for the districts being nested within the intervention arms. Although this was the most appropriate analysis method, it can not properly account for the randomized effects between each district because of the limited number of districts. Lastly, the conclusions drawn from this study can not be attributed to the health education campaign. There was no data collected from the districts prior to the

implementation of the health campaign limiting our results to a descriptive discussion of the knowledge and attitudes within each district.

The limitations of the focus group discussion were primarily due to miscommunications. Upon the formation of the research proposal, the limited qualifications of the focus group moderator and note taker was unknown. Additionally, the student researcher did not have the appropriate qualitative background to appropriately lead the team. These limitations caused missing qualitative data in the transcription process. In country, there was miscommunication as to the exact communities within each district where the health education campaign was implemented. Therefore, one community was classified as a control even though its location was in an intervention district. The results from this particular community may have skewed the data to over represent the health education campaign.

5.6 Conclusion

Overall the implementation of the health education campaign did not affect the knowledge of Buruli ulcer disease among cocoa farmers within the Ashanti region of Ghana. All chosen districts were highly endemic regions; therefore, it was not surprising all the districts displayed an understanding of the pathology, transmission, treatment, and preventative behaviors of BU. The uniformed knowledge suggests that the continued health education campaign should focus on the complex issues surrounding

the disease such as why avoiding unclean water is an appropriate preventative behavior but not an appropriate treatment for the disease. Also, it is important to the continued health education campaign focus on reducing the barriers to treatment. The interview-assisted surveys demonstrated the participant's knowledge yet the focus group discussions showed there was a gap between the knowledge and executing the proper behaviors.

The control districts reported significantly higher negative attitudes toward a victim experiencing BU when compared to the intervention districts. The implementation of the health education campaign within the last year trained many new community based health volunteers that may have in turn caused more discussion about the disease. The health education campaign identified cases and brought to light those in their own community who were suffering from the disease. The focus on Buruli ulcer disease and increased effort of case detection from the health education campaign may have decreased stigmatization and increased acceptance of BU victims within the intervention district. The difference in attitudes among the intervention and control districts suggests education of the disease needs to include an emphasized component on acceptance of BU victims.

Appendix A

District	Date Trained	Community Based Volunteers	Technical Staff	Health Workers	Total
Ahafo Ano North	October 16-18, 2012	15	9	11	35
Atwima Mponua	November 21-23, 2012	19	5	10	34
Atwima Nwabiagya	November 21-23, 2012	17	5	10	32
Total		51	19	31	**101**

Table 9: Number of Trained Staff through the Local NGOs for the Health Education Campaign

Appendix B

Table 10: Number of Buruli Ulcer Materials Distributed During Health Education Campaign

District	Buruli Ulcer Materials					
	Posters	**Packets**	**ACT Now Cards**	**Comics**	**Guide Booklets**	**Total**
Ahafo Ano North	150	100	180	35	15	380
Atwima Mponua	125	80	160	30	20	415
Atwima Nwabiagya	125	70	160	30	20	55
Total	400	250	500	95	55	**1300**

Appendix C

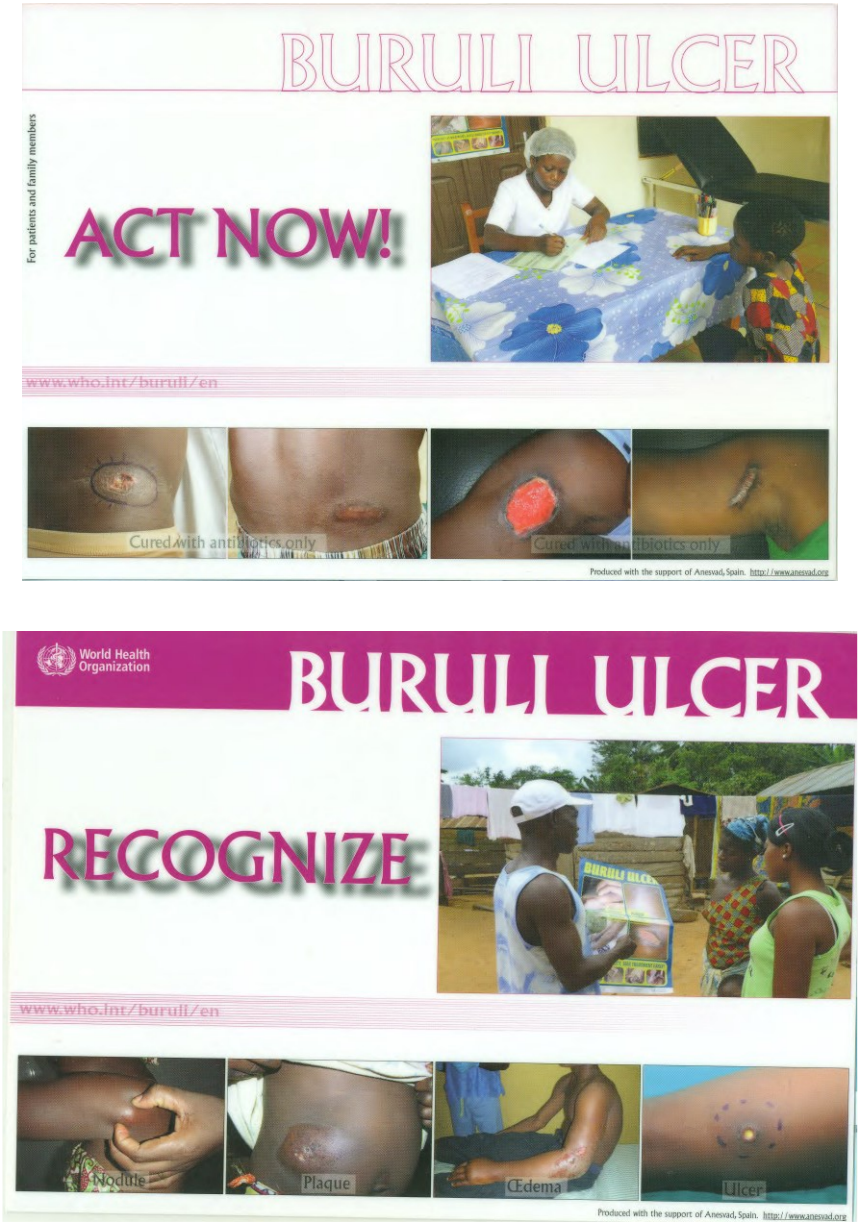
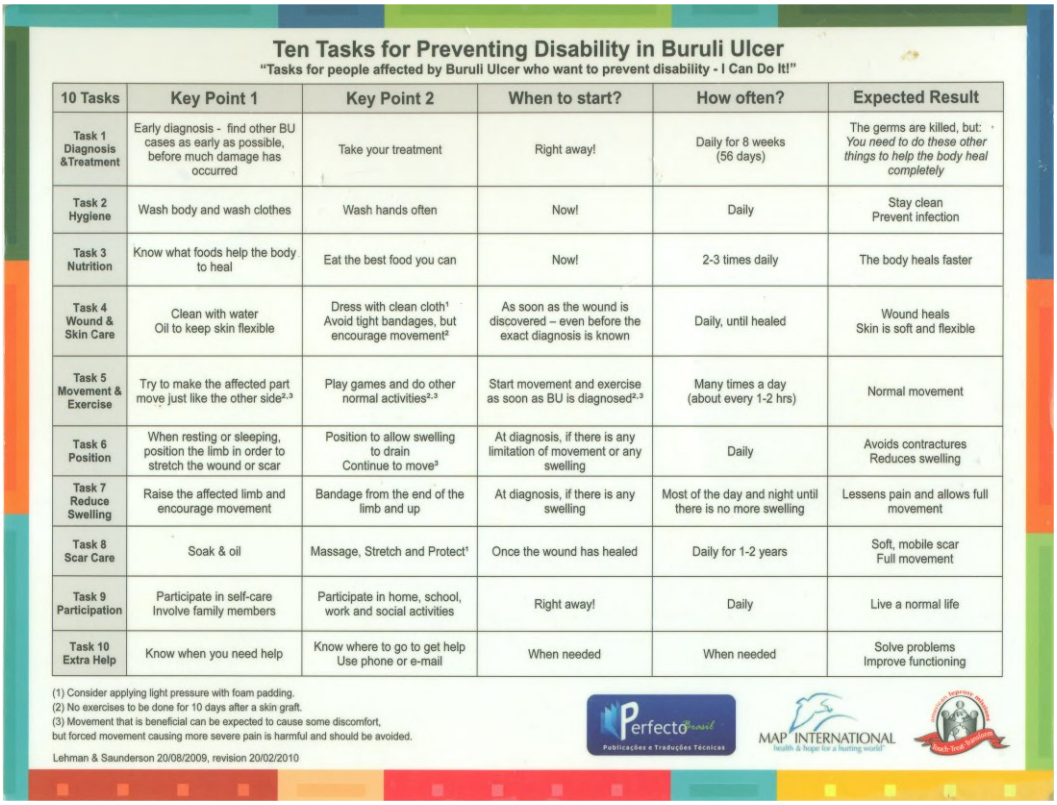


Figure 12: Example of Laminated Cards Passed out in the Intervention Districts

Appendix D



Ten Tasks for Preventing Disability in Buruli Ulcer

"Tasks for people affected by Buruli Ulcer who want to prevent disability - I Can Do It!"

10 Tasks	Key Point 1	Key Point 2	When to start?	How often?	Expected Result
Task 1 Diagnosis &Treatment	Early diagnosis - find other BU cases as early as possible, before much damage has occurred	Take your treatment	Right away!	Daily for 8 weeks (56 days)	The germs are killed, but: *You need to do these other things to help the body heal completely*
Task 2 Hygiene	Wash body and wash clothes	Wash hands often	Now!	Daily	Stay clean Prevent infection
Task 3 Nutrition	Know what foods help the body to heal	Eat the best food you can	Now!	2-3 times daily	The body heals faster
Task 4 Wound & Skin Care	Clean with water Oil to keep skin flexible	Dress with clean cloth[1] Avoid tight bandages, but encourage movement[2]	As soon as the wound is discovered – even before the exact diagnosis is known	Daily, until healed	Wound heals Skin is soft and flexible
Task 5 Movement & Exercise	Try to make the affected part move just like the other side[2,3]	Play games and do other normal activities[2,3]	Start movement and exercise as soon as BU is diagnosed[2,3]	Many times a day (about every 1-2 hrs)	Normal movement
Task 6 Position	When resting or sleeping, position the limb in order to stretch the wound or scar	Position to allow swelling to drain Continue to move[3]	At diagnosis, if there is any limitation of movement or any swelling	Daily	Avoids contractures Reduces swelling
Task 7 Reduce Swelling	Raise the affected limb and encourage movement	Bandage from the end of the limb and up	At diagnosis, if there is any swelling	Most of the day and night until there is no more swelling	Lessens pain and allows full movement
Task 8 Scar Care	Soak & oil	Massage, Stretch and Protect[1]	Once the wound has healed	Daily for 1-2 years	Soft, mobile scar Full movement
Task 9 Participation	Participate in self-care Involve family members	Participate in home, school, work and social activities	Right away!	Daily	Live a normal life
Task 10 Extra Help	Know when you need help	Know where to go to get help Use phone or e-mail	When needed	When needed	Solve problems Improve functioning

(1) Consider applying light pressure with foam padding.
(2) No exercises to be done for 10 days after a skin graft.
(3) Movement that is beneficial can be expected to cause some discomfort, but forced movement causing more severe pain is harmful and should be avoided.

Lehman & Saunderson 20/08/2009, revision 20/02/2010

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Figure 13: Example of Guide Sheet Given to Community Health Workers to Inform the Community about BU

Appendix E

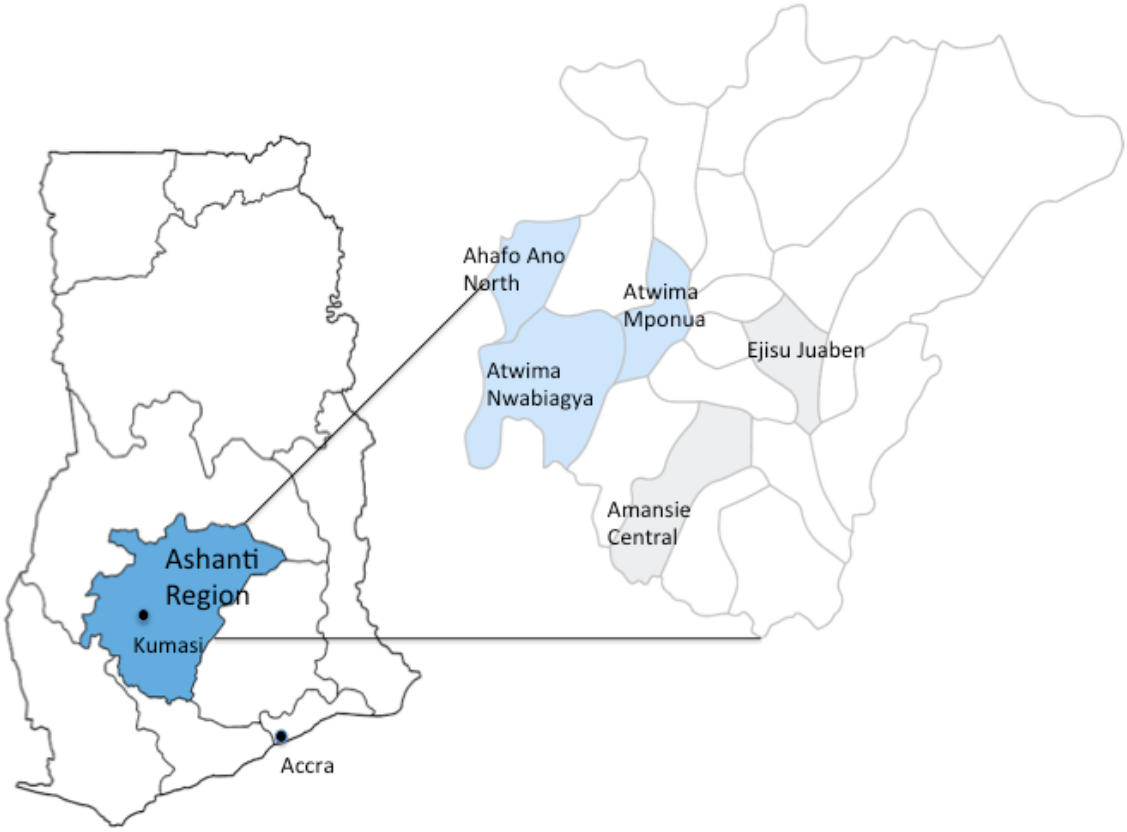

Figure 14: Map of Intervention and Control Districts Within the Ashanti Region of Ghana

Appendix F

Table 11: Numbers of Cocoa Farmers who Participated in the Interview-Assisted Surveys

Districts	Communities N					Totals	
Ahafo Ano North	Dwaaho 24	Konkori 24	Manfo 27			75	
Atwima Mponua	Aniamoa 24	Atuntuma 24	Kyease 1	Ntoboroso 23		72	
Atwima Nwabiagya	Gyankobaa 6	Hiawu Besease 22	Nrebehi 21	Nwobiagya 12		61	**Intervention Total: 208**
Amansie Central	Abubuasin 37	Wromanso 35				72	
Ejisu Juaben	Achiase 12	Adumasa 6	Bomfa 17	Booma 4	Nobewan 21	60	**Control Total: 132**
						340	

Appendix G

Table 12: Numbers of Cocoa Farmers who Participated in the Focus Group Discussions

Districts	Community	N	Total	
Ahafo Ano North	Achina	12		
Atwima Mponua	Bontomuruso	12		**Intervention Total: 24**
Atwima Nwabiagya	Sepaase	10		
Ejisu Juaben	Booma	12		**Control Total: 22**
			46	

Appendix H

UNIQUE PARTICIPANT ID: [___][___] - [___][___][___] - [___][___][___]

ASSESSMENT OF COCOA FARMERS' KNOWLEDGE, ATTITUDE, AND PRACTICE OF BURULI ULCER

Interview-Assisted Survey

INCLUSION CRITERIA		
106.	What district do you live in?	☐ Ahafo Ano North ☐ Atwima Mponua ☐ Asante Akim North ☐ Amansie Central ☐ Atwima Nwabiagya ☐ Ejisu Juaben
107.	What community do you live in?	
108.	How old are you?	
109.	Are you currently a cocoa farmer?	☐ Yes ☐ No
110.	Have you taken this survey in the past month?	☐ Yes ☐ No
PERSONAL INFORMATION		
201.	What is your gender?	☐ Female ☐ Male
202.	Years of experience as a cocoa farmer?	
203.	Do you have any children ages 1 day to 15 years?	☐ Yes ☐ No
204.	Do you have any children ages 16 years and above?	☐ Yes ☐ No
205.	What is your marital status?	☐ Single ☐ Married ☐ Divorced ☐ Separated ☐ Widow/widower
206.	What is your highest level of education?	☐ Primary ☐ JHS/MSLC ☐ Secondary ☐ Tertiary ☐ None ☐ Other: (specify)_____
207.	What are other current occupations do you have?	☐ Trader ☐ Artisan ☐ Teacher ☐ Health worker ☐ Only cocoa farming ☐ Other: (specify)_____
BURULI ULCER KNOWLEDGE		
In this next section, I would like to ask you about your current knowledge and attitudes of Buruli ulcer disease. It is okay if you do not know the answers, we ask that you answer each question to the best of your ability.		
301.	Are you aware of Buruli ulcer disease?	☐ Yes ☐ No

If No, please proceed to the information session on Buruli ulcer disease					
302.	Where did you hear about Buruli ulcer disease?		Yes	No	
		Home	☐	☐	
		TV	☐	☐	
		Radio program	☐	☐	
		Hospital	☐	☐	
		Hospital worker or volunteer	☐	☐	
		Community Durbar	☐	☐	
		Other (Specify) : _____			
303.	What are the causes of Buruli ulcer disease?		Yes	No	Not Sure
		A specific bacterium	☐	☐	☐
		All bacteria or germs	☐	☐	☐
		Stagnant water	☐	☐	☐
		Bad spirits/curses	☐	☐	☐
		Poor sanitation	☐	☐	☐
		Insect bite	☐	☐	☐
		Witches/ witchcraft	☐	☐	☐
		Other (Specify) : _____			
304.	What types of places is Buruli ulcer disease often found?		Yes	No	Not Sure
		Mountains	☐	☐	☐
		Swampy areas	☐	☐	☐
		Stagnant water	☐	☐	☐
		Unkempt cocoa farm areas	☐	☐	☐
		Fast flowing rivers	☐	☐	☐
		Surface mining areas	☐	☐	☐
		Valleys and hills	☐	☐	☐
		Other (Specify) : _____			
305.	What are things that facilitate the transmission of Buruli ulcer disease?		Yes	No	Not Sure
		Swimming in ponds or rivers	☐	☐	☐
		Mosquitos	☐	☐	☐
		Being of child bearing age	☐	☐	☐
		Exposed skin in ponds	☐	☐	☐

		Having HIV/AIDS	☐	☐	☐
		Other (Specify) : _____			
306.	What are the signs and symptoms of Buruli ulcer disease?		**Yes**	**No**	**Not Sure**
		Nodules or Plaque- Painless swelling under the skin, usually very firm	☐	☐	☐
		Rash- Change of skin color and texture of skin	☐	☐	☐
		Oedema- Fluid build-up in the body	☐	☐	☐
		Change of skin color	☐	☐	☐
		Ulcers- Break in the skin accompanied by whitish-yellowish slough	☐	☐	☐
		Deformations- Change in the shape of the limb or affected area	☐	☐	☐
		Skin is painful to the touch	☐	☐	☐
		Other (Specify) : _____			
307.	What parts of the body does the disease usually affect?		**Yes**	**No**	**Not Sure**
		Leg	☐	☐	☐
		Arm	☐	☐	☐
		Face	☐	☐	☐
		Chest	☐	☐	☐
		Neck	☐	☐	☐
		Eye	☐	☐	☐
		Back	☐	☐	☐
		Other (Specify) : _____			
308.	What age groups are most commonly affected by Buruli ulcer disease?		**Yes**	**No**	**Not Sure**
		15 years and below	☐	☐	☐
		16-44 years old	☐	☐	☐
		45 years and above	☐	☐	☐
		Other (Specify) : _____			

UNIQUE PARTICIPANT ID: [___][___] - [___][___][___] - [___][___][___]

309.	Is Buruli ulcer disease curable?		Yes ☐	No ☐	Not Sure ☐
310.	What are available treatments to Buruli ulcer disease?		Yes	No	Not Sure
		Specific oral antibiotics	☐	☐	☐
		Specific injectable antibiotics	☐	☐	☐
		Immunizations	☐	☐	☐
		Drinking clean water	☐	☐	☐
		Topical ointment	☐	☐	☐
		Surgery	☐	☐	☐
		No treatment is available	☐	☐	☐
		Other (Specify) : _____			
311.	How does one prevent him/herself from Buruli ulcer disease?		Yes	No	Not Sure
		Wearing protective clothing	☐	☐	☐
		Washing oneself after contact with stagnant water	☐	☐	☐
		Eating healthy foods	☐	☐	☐
		Family planning	☐	☐	☐
		Use of condoms	☐	☐	☐
		Clean living conditions	☐	☐	☐
		Early detection of signs and symptoms	☐	☐	☐
		Other (Specify) : _____			
312.	How does one prevent complications with Buruli ulcer disease?		Yes	No	Not Sure
		Going to health facility for case management	☐	☐	☐
		Early detection of signs and symptoms	☐	☐	☐
		Taking the full dose of antibiotics	☐	☐	☐
		Adhering to advice from experts/health workers	☐	☐	☐
		Seek treatment from herbalist or spiritualist	☐	☐	☐
		Other (Specify) : _____			

PLEASE REFER TO THE POWERPOINT FOR THE INFORMATIONAL SESSION					
PRACTICE OF BURULI ULCER PREVENTION AND TREATMENT					
401.	If you knew someone with Buruli ulcer disease would you		Yes	No	Not Sure
		Think less of him/her	☐	☐	☐
		Avoid him/her	☐	☐	☐
		Embarrass him/her	☐	☐	☐
		Avoid their family	☐	☐	☐
402.	If your significant other had Buruli ulcer disease, would you continue to have sexual intercourse		Yes	No	
			☐	☐	
403.	Have you ever had Buruli ulcer disease?		Yes	No	
			☐	☐	
If No, please proceed to question 423					
404.	How long ago did you have Buruli ulcer disease?				
405.	While you had Buruli ulcer disease, did you believe anyone		Yes	No	Not Sure
		Thought less of you	☐	☐	☐
		Avoided you	☐	☐	☐
		Embarrassed you	☐	☐	☐
		Avoided your family	☐	☐	☐
406.	While you had Buruli ulcer disease, did you believe that it affected your		Yes	No	Not Applicable
		Occupation	☐	☐	☐
		Sexual Activities	☐	☐	☐
		Community Positions	☐	☐	☐
		Marriage	☐	☐	☐
		Family Life	☐	☐	☐
		Fertility	☐	☐	☐
407.	What did you do when you had Buruli ulcer disease?		Yes	No	Not Sure
		Took antibiotics	☐	☐	☐
		Prayed	☐	☐	☐

		Consulted a herbalist or spiritualist	☐	☐	☐
		Consulted an expert or health workers	☐	☐	☐
		Nothing	☐	☐	☐
		Other (Specify) : _____			
408.	At what stage did you seek treatment for the disease?	☐ Nodule ☐ Plaque ☐ Oedema	☐ Small Ulcer ☐ Large Ulcer ☐ Osteomyelitis	☐ Deformed Stage ☐ Unsure ☐ Other (specify):	
409.	Did you seek treatment at the government hospital/clinic?		Yes ☐	No ☐	
If No, please proceed to question 411					
410.	Why did you seek treatment at this location?		Yes	No	
		Low cost of treatment	☐	☐	
		Nearest to me	☐	☐	
		Appropriate place for BU	☐	☐	
		Effective treatment	☐	☐	
		Confident in their method of treatment	☐	☐	
		Fear of surgery	☐	☐	
		Fear of chemotherapy	☐	☐	
		Other (Specify) : _____			
411.	Did you seek treatment at a non-government hospital or clinic?		Yes ☐	No ☐	
If No, please proceed to question 413					
412.	Why did you seek treatment at this location?		Yes	No	
		Low cost of treatment	☐	☐	
		Nearest to me	☐	☐	
		Appropriate place for BU	☐	☐	
		Effective treatment	☐	☐	
		Confident in their method of treatment	☐	☐	

		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
413.	Did you seek treatment at a village doctor/ traditional healer?		Yes ☐	No ☐
If No, please proceed to question 415				
414.	Why did you seek treatment at this location?		Yes	No
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
415.	Did you seek treatment from a licensed chemical seller?		Yes ☐	No ☐
If No, please proceed to question 417				
416.	Why did you seek treatment at this location?		Yes	No
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
417.	Did you seek treatment from a pharmacist?		Yes ☐	No ☐
If No, please proceed to question 419				

418.	Why did you seek treatment at this location?		Yes	No
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify): _____		
419.	Did you seek treatment from a place not		Yes ☐	No ☐
If No, please proceed to question 422				
420.	Where was that place?			
421.	Why did you seek treatment at this location?		Yes	No
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify): _____		
422.	How much did you spend to treat or manage the disease?	[___][___][___] Cedis	[___][___] Pesewas	
423.	Have any of your children had Buruli ulcer		Yes ☐	No ☐
If No, please thank the participant for their time. If Yes, please proceed to the Child Questionnaire				

Nodule Stage


Plaque Stage


Oedema Stage


Small Ulcer Stage


Large Ulcer Stage

Osteomyelitis Stage

Deformed Stage

UNIQUE PARTICIPANT ID: [___][___] - [___][___][___] - [___][___][___]

ASSESSMENT OF COCOA FARMERS' KNOWLEDGE, ATTITUDE, AND PRACTICE OF BURULI ULCER

Child Survey

PLEASE COMPLETE ONE OF THESE PER CHILD WHO HAS EXPERIENCED BURULI ULCER DISEASE					
501.	How long ago did your child experience Buruli ulcer disease? (Years)				
502.	How old is your child now?				
503.	What is the gender of your child?	☐ Female	☐ Male		
504.	What did you do when your child had Buruli ulcer disease?		**Yes**	**No**	**Not Sure**
		Took antibiotics	☐	☐	☐
		Prayed	☐	☐	☐
		Consulted a herbalist or spiritualist	☐	☐	☐
		Consulted an expert or health workers	☐	☐	☐
		Nothing	☐	☐	☐
		Other (Specify) : _____			
505.	At what stage of the disease did your child seek treatment?	☐ Nodule ☐ Small Ulcer ☐ Deformed Stage ☐ Plaque ☐ Large Ulcer ☐ Unsure ☐ Oedema ☐ Osteomyelitis ☐ Other (specify): _____			
506.	Did you seek treatment (for your child) at the government hospital/clinic?		**Yes** ☐	**No** ☐	
If No, please proceed to question 508					
507.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**	
		Low cost of treatment	☐	☐	
		Nearest to me	☐	☐	
		Appropriate place for BU	☐	☐	
		Effective treatment	☐	☐	
		Confident in their method of treatment	☐	☐	
		Fear of surgery	☐	☐	
		Fear of chemotherapy	☐	☐	
		Other (Specify) : _____			

508.	Did you seek treatment (for your child) at a non-government hospital or clinic?		**Yes** ☐	**No** ☐
If No, please proceed to question 510				
509.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
510.	Did you seek treatment (for your child) at a village doctor/ traditional healer?		**Yes** ☐	**No** ☐
If No, please proceed to question 512				
511.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
512.	Did you seek treatment (for your child) from a licensed chemical seller?		**Yes** ☐	**No** ☐
If No, please proceed to question 514				
513.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐

		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
514.	Did you seek treatment (for your child) from a pharmacist?		**Yes** ☐	**No** ☐
If No, please proceed to question 516				
515.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		
516.	Did you seek treatment (for your child) from a place not previously mentioned?		**Yes** ☐	**No** ☐
If No, please proceed to question 519				
517.	Where was that place?			
518.	Why did you seek treatment (for your child) at this location?		**Yes**	**No**
		Low cost of treatment	☐	☐
		Nearest to me	☐	☐
		Appropriate place for BU	☐	☐
		Effective treatment	☐	☐
		Confident in their method of treatment	☐	☐
		Fear of surgery	☐	☐
		Fear of chemotherapy	☐	☐
		Other (Specify) : _____		

519.	How much did you spend to treat or manage the disease?	[____][____][____] **Cedis** [____][____] **Pesewas**
520.	Have any of your other children had Buruli ulcer disease?	**Yes** ☐ **No** ☐
If No, please thank the participant for their time. **If Yes, please complete another Child Questionnaire for that child.**		

Appendix I

Focus Group Moderator's Guide
Buruli Ulcer Awareness, Prevention, and Treatment in Ghana
July- August 2013

I. Informed Consent (10 minutes)

The student researcher will conduct this part.

II. Introduction (5 minutes)

Hello, my name is _____, and I am the moderator for this discussion. My job is to move the conversation along and make sure that we cover several different subjects and to ensure that everyone here gets involved. The purpose of this session is to discuss attitudes surrounding Buruli ulcer disease. As you will see, there are no right or wrong answers to any of the questions. The purpose is to find out what your personal opinions are, and everyone's opinion is equally important to us.

I am glad that you are taking time out of your time to talk with me today. We will be covering several topics, and I encourage you to speak freely. First, we need to cover some ground rules for the focus group.

1. Respect for opinions. In fact, you may find that you disagree with an opinion voice here by another person. That is OK, and I hope you will say so when that happens in a respectful and polite way. You also may change your mind in the middle of our discussion, perhaps as a result of something that someone else says, and again I hope you will say so, if and when that happens.

2. Important rule: one person speaking at one time. Because we want to respect everyone and make sure that everyone is heard, we have one basic rule in this session- we will allow only one person to speak at a time. We want to have an organized session, and in order to do this, I ask that you respect the person who is speaking, and wait for him to finish his thoughts.

You are here to respresent other people who are not in the room-share your views; speak up, your opinion is important to us.

Participant Introductions. Let's go around the room- tell us how many years your occupation has been a cocoa farmer.

To the moderator: what follows is a list of questions on some important topics that will be covered in this qualitative survey. The list is divided into 5 different sections. Each section contains more questions than you could probably ask during the one and a half hours. However, keep in mind that we do not expect each participant to provide an answer to each question. The purpose of the guide is to instigate the discussion; it is helping the moderator to keep participants to stay within the topic. As long as the participants are discussing the topic they are providing us with useful information. On the other hand, always keep the list of questions in front of you in case the discussion looses

momentum. Please note that it is important to stay within the time limits anticipated for each section.

II. General Mood (10 minutes)
Purpose: Allow participants to express personal views that will initiative general flow for the other topics.

1. You were all selected to join this discussion group based on the fact that you are a cocoa farmer. How does being a cocoa farmer affect your life?
2. What are the largest problems you face on a daily basis as a cocoa farmer? Does it affect your family or community? Does it affect your lifestyle? In what ways?
3. Do you ever discuss these problems with your family? Community? Employer?

III. Awareness (10 minutes)
Purpose: Understand the background knowledge that each participant has on Buruli ulcer disease.

1. When did you first learn of Buruli ulcer disease? In what context, did you learn about BU?
2. How often are you reminded of Buruli ulcer disease? Do you think that is too much or too little?
3. What ways do you would be more effective for a health education campaign to make the community aware of BU? Change target population? Use a different method of delivering materials?

IV. Effectiveness of Referral System (20 minutes)
Purpose: Understand the barriers that are encountered when using the current referral system.

1. Are you aware of health facilities that can provide care for Buruli ulcer disease? How many? How far are these health facilities?
2. Have you or anyone you know experienced the referral system in terms of Buruli ulcer disease? Was it a good experience? Why or why not?
3. When you use the health facility, do you believe that the health facility did all that it could do for? What could it have done better? Do you believe that to be a feasible request?
4. If you have gone to a local health facility and have been referred to the district hospital, did the health facility and district hospital provide you conflicting messages? Did there appear to be communication between the local and district facilities?
5. If you have gone to a local health facility and have been referred to the district hospital but did not go, why? What would have caused you to go?

V. Attitudes (30 minutes)
Purpose: Understand the attitudes that the community has toward Buruli ulcer disease.

1. How would you describe the general attitude toward Buruli ulcer disease? Is there a specific experience that stands out in your mind?
2. Have you changed your lifestyle or any practices since you learned of BU? Why or why not?
3. Do you want to change your behaviors but do not feel as though you can? Why or why not?

4. If you realized you were presenting with symptoms of BU, when would decide to go to a health facility? Why?

5. Are there any practices you know that you should not do (because it puts you at a higher risk for BU); yet do anyway? What motivates you to continue with that behavior?

6. What do you think causes Buruli ulcer disease? Where did find this out?

7. If FGD is being conducted in an intervention district: Have you noticed a change the community's awareness of Buruli ulcer disease? In what way?

If FGD is being conducted in a control district: Have you noticed cocoa farmers from other community's have an increased level of awareness of Buruli ulcer disease? In what way?

VI. Close (5 minutes)
Purpose: Open to any questions/concerns.

1. Is there anything we missed that you would like to talk about?
2. What is the most important point we discussed?

Appendix J

Knowledge Variables		N (%)	Intervention Districts			Control Districts	
			Ahafo Ano North	Atwima Mponua	Atwima Nwabiagya	Amansie Central	Ejisu Juaben
Aware of BU		331 (97.35)	75 (100.00)	69 (95.83)	59 (96.72)	72 (100.00)	56 (93.33)
Causes of BU							
	Germs	191 (66.78)	47 (71.21)	31 (58.49)	29 (56.86)	42 (60.87)	42 (89.36)
	Stagnant Water	259 (86.33)	63 (91.30)	42 (73.68)	44 (81.48)	67 (97.10)	43 (84.31)
	Poor Sanitation	195 (66.33)	52 (76.47)	35 (62.50)	27 (50.94)	46 (66.67)	35 (72.92)
	Spirits/Witches	65 (22.89)	20 (31.75)	12 (22.22)	8 (14.81)	16 (23.19)	9 (20.45)
	Insects	76 (27.34)	25 (37.31)	11 (21.15)	11 (20.75)	16 (23.53)	13 (34.21)
	Don't Know	22 (6.81)	4 (5.41)	8 (12.50)	5 (8.47)	2 (2.82)	3 (5.45)
Places BU Found							
	Swampy Areas	289 (94.44)	69 (97.18)	55 (93.22)	45 (80.36)	69 (100.00)	51 (100.0)
	Unkempt Cocoa Farms	130 (45.3)	42 (61.76)	21 (36.21)	23 (42.59)	16 (25.81)	28 (62.22)
	Surface Mining Areas	156 (52.35)	37 (52.86)	28 (46.67)	23 (42.59)	39 (55.71)	29 (65.91)
	Mountains/Valleys	74 (27.31)	25 (37.88)	13 (25.49)	14 (27.45)	2 (2.90)	20 (58.82)
	Don't Know	14 (4.39)	3 (4.05)	4 (6.45)	3 (5.08)	1 (1.43)	3 (5.56)
Signs and Symptoms							
	Nodules/Plaques	287 (91.69)	73 (98.65)	57 (86.36)	48 (82.76)	60 (96.77)	49 (92.45)
	Edema	192 (64.86)	51 (71.83)	32 (50.79)	33 (62.26)	42 (67.74)	34 (72.34)
	Ulcers	207 (68.54)	55 (74.32)	34 (53.97)	33 (58.93)	49 (79.03)	36 (76.60)
	Deformations	192 (62.54)	53 (71.62)	28 (43.08)	36 (62.07)	38 (61.29)	37 (77.08
	Painful Skin	138 (48.76)	42 (61.76)	14 (25.00)	26 (46.43)	34 (54.84)	22 (53.66)
	Don't Know	5 (1.57)	1 (1.33)	0 (0.00)	1 (1.69)	0 (0.00)	3 (5.36)

Appendix K

Table 13: Covariates Associated with the Crude, Adjusted, and Clustered Odds Ratio of A Participant Responding that Germs Cause Buruli Ulcer Disease

		Crude		Adjusted		Adjusted and Clustered		
		OR	95%	OR	95%	OR	95%	p-value
Intervention								
	Control	1.00	Ref	1.00	Ref	1.00	Ref	
	Intervention	0.65	(0.39-1.08)	.71	(0.41-1.24)	0.71	(0.19-2.71)	0.62
Age								
		0.98	(0.97 – 1.00)	0.98	(0.96-1.00)	0.98	(0.95-1.00)	0.12
Gender								
	Female	1.00	Ref	1.00	Ref	1.00	Ref	
	Male	1.70	(1.03-2.79)	1.72	(0.96-3.11)	1.72	(0.83-3.59)	0.15
Education								
	None	1.00	Ref	1.00	Ref	1.00	Ref	
	Primary	0.54	(0.26-1.12)	0.42	(0.19-0.94)	0.42	(0.18-1.00)	0.05*
	JHS/MSLC	0.77	(0.40-1.49)	0.63	(0.30-1.33)	0.63	(0.37-1.07)	0.09
	Secondary	2.54	(0.52-12.41)	1.78	(0.33-9.59)	1.78	(0.83-3.81)	0.14
	Tertiary	0.39	(0.09-1.73)	0.23	(0.04-1.32)	0.23	(0.09-0.59)	0.00*
Child Below 15 yrs								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.43	(0.84-2.43)	1.05	(0.54-2.03)	1.05	(0.57-1.92)	0.88
Only Occupation: Farming								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.96	(0.73-1.96)	1.09	(0.61-1.96)	1.10	(0.73-1.63)	0.67

Appendix L

Table 14: Covariates Associated with the Adjusted Odds Ratio of a Participant's District Predicts the Participant Responding that Germs Cause Buruli Ulcer Disease

			Adjusted	
		OR	95%	p-value
District				
	Ahafo Ano North	1.00	Ref	
	Atwima Mponua	0.53	(0.23- 1.21)	0.13
	Atwima Nwabiagya	0.73	(0.30- 1.76)	0.49
	Amansie Central	0.53	(0.25- 1.15)	0.11
	Ejisu Juaben	4.45	(1.33- 14.88)	0.02*
Age				
		0.97	90.95- 1.00)	0.02*
Gender				
	Female	1.00	Ref	
	Male	1.73	(0.94-3.20)	0.08
Education				
	None	1.00	Ref	
	Primary	0.36	(0.16- 0.81)	0.01*
	JHS/MSLC	0.53	(0.24- 1.15)	0.11
	Secondary	1.65	(0.29- 9.28)	0.57
	Tertiary	0.21	(0.33- 1.30)	0.09
Child Below 15 yrs				
	No	1.00	Ref	
	Yes	0.94	(0.46-1.90)	0.86
Only Occupation: Farming				
	No	1.00	Ref	
	Yes	1.25	(0.67-2.35)	0.48

Appendix M

Table 15: Covariates Associated with the Crude, Adjusted, and Clustered Odds Ratio of a Participant Responding that Nodules/Plaques are a Sign or Symptom of BU

		Crude		Adjusted		Adjusted and Clustered		
		OR	95%	OR	95%	OR	95%	p-value
Intervention								
	Control	1.00	Ref	1.00	Ref	1.00	Ref	
	Intervention	0.49	(.019-1.26)	0.66	(0.24-1.78)	0.66	(0.21-2.11)	0.48
Age								
		0.98	(0.96-1.01)	0.98	(0.95-1.02)	.98	(0.96-1.00)	0.08
Gender								
	Female	1.00	Ref	1.00	Ref	1.00	Ref	
	Male	0.91	(0.41-2.04)	0.99	(0.37-2.70)	0.99	(0.38-2.60)	0.99
Education								
	None	1.00	Ref	1.00	Ref	1.00	Ref	
	Primary	2.26	(0.54-9.41)	1.95	(0.45-8.52)	1.95	(0.45-8.53)	0.37
	JHS/MSLC	0.91	(0.33-2.47)	1.00	(0.32-3.16)	1.00	(0.11-8.86)	1.00
	Secondary	1.26	(0.14-11.35)	1.41	(0.13-15.12)	1.41	(0.07-29.59)	0.83
	Tertiary	0.34	(0.06-2.01)	0.92	(0.08-11.00)	0.92	(0.05-17.41)	0.96
Child Below 15 yrs								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.22	(0.50-3.00)	1.06	(0.35-3.12)	1.06	(0.63-1.79)	0.83
Only Occupation: Farming								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.56	(0.69-3.51)	1.43	(0.54-3.76)	1.43	(0.82-2.49)	0.21

Appendix N

Table 16: Covariates Associated with the Adjusted Odds Ratio of a Participant's District Predicts the Participant Responding that a Nodule/Plaque is a Sign/Symptom of BU

		Adjusted		
		OR	95%	p-value
District				
	Ahafo Ano North	1.00	Ref	
	Atwima Mponua	0.11	(0.01- 0.90)	0.04*
	Atwima Nwabiagya	0.07	(0.01- 0.63)	0.02*
	Amansie Central	0.41	(0.04- 4.69)	0.47
	Ejisu Juaben	0.15	(0.02- 1.39)	0.10
Age				
		0.99	(0.96- 1.03)	0.74
Gender				
	Female	1.00	Ref	
	Male	1.02	(0.37- 2.80)	0.97
Education				
	None	1.00	Ref	
	Primary	2.19	(0.48- 10.02)	0.31
	JHS/MSLC	1.48	(0.43- 511)	0.53
	Secondary	1.85	(0.16- 21.15)	0.62
	Tertiary	1.48	(0.11- 19.28)	0.76
Child Below 15 yrs				
	No	1.00	Ref	
	Yes	1.15	(0.37- 3.56)	0.81
Only Occupation: Farming				
	No	1.00	Ref	
	Yes	1.13	(0.40- 3.13)	0.82

Appendix O

Table 17: Description of the Participant's Knowledge of Treatment and Prevention Variables Categorized by District

			Intervention Districts			Control Districts	
Knowledge Variables		N (%)	Ahafo Ano North	Atwima Mponua	Atwima Nwabiagya	Amansie Central	Ejisu Juaben
Available Treatments							
	Antibiotics	243 (82.37)	58 (82.86)	44 (74.58)	44 (86.27)	53 (75.71)	44 (97.78)
	Immunizations	116 (42.80)	28 (43.08)	16 (27.59)	22 (44.90)	35 (51.47)	15 (48.39)
	Drinking Clean Water	86 (28.20)	17 (25.37)	10 (15.62)	20 (37.04)	20 (28.17)	19 (38.78)
	Surgery	204 (66.67)	52 (73.24)	42 (65.62)	34 (62.96)	36 (53.73)	40 (80.00)
	Don't Know	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Preventative Behaviors of BU							
	Protective Clothing	205 (66.56)	48 (70.59)	33 (53.23)	32 (57.14)	48 (68.57)	44 (84.64)
	Washing Oneself	233 (75.16)	59 (84.29)	41 (64.06)	34 (62.96)	56 (80.00)	43 (82.69)
	Clean Living Conditions	236 (74.92)	51 (75.00)	47 (71.21)	44 (78.57)	55 (78.57)	39 (70.91)
	Early Detection of BU	208 (65.62)	57 (81.43)	35 (53.03)	34 (59.65)	42 (60.00)	40 (74.07)
	Don't Know	25 (7.35)	4 (5.33)	9 (12.33)	4 (6.67)	2 (2.78)	6 (10.00)
Preventative Behaviors of Complications of BU							
	Health Facility	319 (99.38)	71 (100.00)	64 (98.46)	59 (100.00)	70 (98.59)	55 (100.00)
	Taking Antibiotics	182 (57.23)	47 (66.20)	33 (49.23)	35 (60.34)	33 (46.48)	35 (66.04)
	Herbalist	75 (24.27)	15 (22.39)	15 (23.44)	12 (20.69)	23 (33.33)	10 (19.61)
	Don't Know	19 (5.59)	4 (5.33)	7 (9.72)	2 (3.28)	1 (1.39)	5 (8.33)

Appendix P

Table 18: Covariates Associated with the Crude, Adjusted, and Clustered Odds Ratio of a Participant Responding that Antibiotics or Surgery is a Treatment for BU

		Crude		Adjusted		Adjusted and Clustered		
		OR	95%	OR	95%	OR	95%	p-value
Intervention								
	Control	1.00	Ref	1.00	Ref	1.00	Ref	
	Intervention	1.06	(0.56-2.01)	1.15	(0.58-2.29)	1.15	(0.47-2.85)	0.76
Age								
		0.99	(0.98-1.02)	0.99	(0.97-1.02)	0.99	(0.98-1.000	0.18
Gender								
	Female	1.00	Ref	1.00	Ref	1.00	Ref	
	Male	0.82	(0.43-1.53)	0.85	(0.41-1.75)	0.85	(0.45-1.61)	0.61
Education								
	None	1.00	Ref	1.00	Ref	1.00	Ref	
	Primary	1.46	(0.61-3.47)	1.25	(0.51-3.13)	1.25	(0.57-2.74)	0.58
	JHS/MSLC	2.30	(1.03-5.08)	2.03	(0.84-4.92)	2.03	(0.72-5.76)	0.18
	Secondary	0.94	(0.24-3.72)	0.81	(0.18-3.73)	0.81	(0.29-2.27)	0.69
	Tertiary	0.76	(0.14-4.03)	1.35	(0.13-13.61)	1.35	(0.06-0.56)	0.66
Child Below 15 yrs								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	0.86	(0.44-1.78)	0.64	(0.28-1.48)	0.64	(0.40-1.03)	0.07
Only Occupation: Farming								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	0.77	(0.41-1.46)	0.75	(0.36-1.58)	0.75	(0.21-2.71)	0.66

Appendix Q

Table 19: Covariates Associated with the Adjusted Odds Ratio of a Participant's District Predicts the Participant Responding that Antibiotics or Surgery is an Available Treatment for Bu

		Adjusted		
		OR	95%	p-value
District				
	Ahafo Ano North	1.00	Ref	
	Atwima Mponua	0.19	(0.06- 0.62)	0.01*
	Atwima Nwabiagya	0.40	(0.10- 1.61)	0.20
	Amansie Central	0.31	(0.09- 1.05)	0.06
	Ejisu Juaben	0.35	(0.09- 1.31)	0.12
Age				
		1.00	(0.97- 1.03)	0.79
Gender				
	Female	1.00	Ref	
	Male	0.83	(0.40- 1.73)	0.62
Education				
	None	1.00	Ref	
	Primary	1.26	(0.49- 3.23)	0.63
	JHS/MSLC	2.19	(0.87- 5.52)	0.10
	Secondary	0.93	(0.16- 4.43)	0.93
	Tertiary	1.68	(0.16- 17.78)	0.67
Child Below 15 yrs				
	No	1.00	Ref	
	Yes	0.61	(0.26- 1.46)	0.27
Only Occupation: Farming				
	No	1.00	Ref	
	Yes	0.78	(0.36- 1.69)	0.53

Appendix R

Table 20: Covariates Associated with the Crude, Adjusted, and Clustered Odds Ratio of a Participant Responding that Early Detection is a Preventative Behavior

		Crude		Adjusted		Adjusted and Clustered		
		OR	95%	OR	95%	OR	95%	p-value
Intervention								
	Control	1.00	Ref	1.00	Ref	1.00	Ref	
	Intervention	0.96	(0.59-1.55)	1.22	(0.73-2.03)	1.22	(0.48-3.11)	0.68
Age								
		0.99	(0.98-1.01)	0.99	(0.97-1.01)	0.99	(0.96-1.01)	0.30
Gender								
	Female	1.00	Ref	1.00	Ref	1.00	Ref	
	Male	1.36	(0.86-2.17)	1.78	(1.03-3.07)	1.78	(1.11-2.83)	0.02*
Education								
	None	1.00	Ref	1.00	Ref	1.00	Ref	
	Primary	0.58	(0.29-1.17)	0.44	(0.21-0.94)	0.44	(0.28-0.68)	0.00*
	JHS/MSLC	0.66	(0.36-1.23)	0.50	(0.24-1.01)	0.50	(0.23-1.16)	0.10
	Secondary	0.45	(0.13-1.29)	0.24	(0.07-0.86)	0.24	(0.06-1.06)	0.06
	Tertiary	0.45	(0.11-1.86)	0.35	(0.07-1.83)	0.35	(0.17-0.73)	0.01*
Child Below 15 yrs								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.11	(0.67-1.84)	0.94	(0.51-1.71)	0.94	(0.28-0.68)	0.81
Only Occupation: Farming								
	No	1.00	Ref	1.00	Ref	1.00	Ref	
	Yes	1.26	(0.79-2.00)	0.98	(0.57-1.69)	0.98	(0.55-1.76)	0.95

Appendix S

Table 21: Covariates Associated with the Adjusted Odds Ratio of a Participant's District Predicts the Participant Responding that Early Detection of BU is a Preventative Behavior

		Adjusted		
		OR	95%	p-value
District				
	Ahafo Ano North	1.00	Ref	
	Atwima Mponua	0.22	(0.10- 0.51)	0.00*
	Atwima Nwabiagya	0.47	(0.19- 1.12)	0.09
	Amansie Central	0.29	(0.13- 0.65)	0.00*
	Ejisu Juaben	0.55	(0.22- 1.35)	0.19
Age				
		0.99	(0.97- 1.01)	0.27
Gender				
	Female	1.00	Ref	
	Male	1.90	(1.07- 3.35)	0.03*
Education				
	None	1.00	Ref	
	Primary	0.37	(0.17- 0.82)	0.01*
	JHS/MSLC	0.46	(0.22- 0.97)	0.04*
	Secondary	0.25	(0.07-0.89)	0.03*
	Tertiary	0.37	(0.07-2.05)	0.26
Child Below 15 yrs				
	No	1.00	Ref	
	Yes	0.90	(0.48- 1.70)	0.76
Only Occupation: Farming				
	No	1.00	Ref	
	Yes	1.04	(0.59- 1.86)	0.89

Appendix T

Table 22: Descriptive Data of Participants' Attitudes Toward Buruli Ulcer Victims

Attitude Variables	N (%)	Intervention Districts			Control Districts	
		Ahafo Ano North	Atwima Mponua	Atwima Nwabiagya	Amansie Central	Ejisu Juaben
Think Less of Them	18 (5.45)	1 (1.35)	3 (4.41)	0 (0.00)	9 (12.68)	5 (8.47)
Avoid Them	17 (5.15)	1 (1.35)	4 (5.88)	0 (0.00)	0 (0.00)	3 (5.08)
Embarrass Them	13 (3.95)	1 (1.35)	2 (2.94)	1 (1.72)	7 (10.00)	2 (3.39)
Avoid Their Family	15 (4.57)	1 (1.35)	2 (2.94)	2 (3.51)	7 (10.00)	3 (5.08)
Continue Sexual Relations with Them	221 (64.53)	57 (77.03)	36 (53.85)	34 (58.62)	40 (55.56)	45 (77.59)

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